LEVEL II

ADA111183

APPENDIX F

DETERMINATION OF CHARACTERISTIC LOADING BEHAVIOR OF MK7-1 AND MK7-2 ARRESTING GEARS BY ANALYSIS OF AIRPLANE TEST DATA

VOUGHT CORPORATION
systems division
an LTV Company

N00019-75-C-0237

CONVERSATION RECORD

CONVERSATION RECORD	1. DATE	2. TIME

3. TYPE OF CONVERSATION

TELEPHONE (*Incoming*) TELEPHONE (*Outgoing*) OFFICE VISIT

4. SUBJECT OF CONVERSATION

5. CALL VISIT MADE BY (*Name of person*)	5a. OFFICE FIRM COMPANY, ETC.	5b. PHONE NO. AND OR EXT.
6. CALL VISIT MADE TO (*Name of person*)	6a. OFFICE FIRM COMPANY, ETC.	6b. PHONE NO. AND OR EXT.

7. SUMMARY OF CONVERSATION, AND IF APPLICABLE, STATEMENT AS TO SUBSEQUENT ACTION TAKEN OR TO BE TAKEN

Basic Report AD-634536

Appendix A + B 672556

C 683374

D 709456

E 923629L

(*IF ADDITIONAL SPACE IS NEEDED, CONTINUE ON REVERSE SIDE*)

8. PRINTED NAME AND TITLE OF PERSON MAKING RECEIVING CALL VISIT	8a. SIGNATURE

APPENDIX F

DETERMINATION OF CHARACTERISTIC LOADING BEHAVIOR
OF MK7-1 AND MK7-2 ARRESTING GEARS BY ANALYSIS
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A

APPENDIX F

DETERMINATION OF CHARACTERISTIC LOADING BEHAVIOR OF MK7-1 AND MK7-2 ARRESTING GEARS BY ANALYSIS OF AIRPLANE TEST DATA

F1.0 Program Purpose, Scope, and Objectives

F1.1 Program Purpose

During analysis of the Mk7-3 arresting gear (presented in Appendix D of this report) considerable differences were observed in the loading characteristics of data from airplane and dead load tests. The airplane tests showed better arresting gear efficiency in the lower weight range. Since the loading behavior of the Mk7-1 and Mk7-2 arresting gears presented in the main body of this report were determined using some dead load test data and since a considerable amount of new aircraft test data had been generated since the original analysis, it was decided to analyze this data to currently assess the loads imparted to aircraft operating from these gears.

It was also desired that the effects of the new heavier (1 7/16 inch diameter) purchase cable on loading behavior of these gear also be assessed.

The loading characteristics of the Mk7-1 and Mk7-2 arresting gears as given in this Appendix supersede and make obsolete those given for the same gears in the main body of the report.

F1.2 Program Scope

Oscillograms representing more than five hundred individual test arrestments were analyzed during the program. The following range of aircraft weights and engaging speeds were covered:

Weight Range: 10,000 to 60,000 pounds
Engaging Speed Range: 70 to 140 knots

F1.3 Program Objectives

The basic objective of the program was the establishment of the characteristic loading behavior as a function of aircraft weight and aircraft engaging speed. This includes statistical analysis to determine loading behavior based on a probability of occurrence.

The following loading characteristics were required:

1. Nondimensional arresting load-stroke diagrams
2. Peak arresting force
3. Arresting force peak to mean ratios
4. The effect of on/off center arrestments
5. The effect of airplane/dead load arrestments
6. Provision for conversion of nondimensional load-stroke diagrams to dimensional values and to force-time histories.

F1.4 Program Approach

The following approach, similar to that of the previous program, was made to determine the loading behavior of the arresting gear:

1. Categorization of available data and selection of test records for analysis
2. Extraction of data from the test records
3. Data analysis (includes statistical analysis)
4. Presentation of data

F2.0 Data Gathering

The categorization of available data, selection of test records, and extraction of data from the oscillograph records was partially accomplished at NAEC Engineering Dept (SI), Lakehurst, N. J. using a procedure similar to the data gathering of the preceding program which is described on pages 16-18 in this report.

A detailed tabulation of the data analyzed giving a breakdown of the data according to weight, engaging speed, etc., is given in Table F1.1.

F3.0 Data Analysis

Data corrections and statistical methods employed on the data were generally in accordance with the methods used during the preceding program which are described on pages 19-24 in the main body of this report.

F4.0 Results of Analysis

Loading characteristics of the Mk7-1 and Mk7-2 arresting gears are generally presented in a manner similar to that given for the arresting gears in the main body of this report. An exception is that dimensioned scales are also provided on nondimensional diagrams. The data, given primarily as a function of weight and engaging speed, are presented in the following forms:

1. Load-stroke diagrams
2. Peak arresting force (parallel to deck)
3. Supplementary information

Tolerance limits, as well as mean values, are given to show fluctuations in the arresting gear loads; these are based on 90% probability that 90% of the data will fall within the tolerance limit band.

F4.1 Nondimensional Load-Stroke Diagrams

F4.1.1 Description

A dimensional load-stroke diagram is made dimensionless by expressing the load (ordinate) portion of the diagram as the ratio of

work to twice the kinetic energy (at engagement) and the stroke (abscissa) portion of the diagram as the ration of stroke to total stroke. The area under such a diagram would be 0.50 provided that the work done during the arrestment is equal to the kinetic energy at engagement. During actual arrestments, however, other forces act, namely airplane thrust which adds to the work done during the arrestment and aerodynamic drag and rolling friction which subtracts from it. The following relationships exist between the parts making up the total arrestment energy: kinetic energy and aerodynamic drag energy contributions vary with engaging speed, the contribution due to engine thrust and rolling friction is constant for constant runout type arresting gear. Therefore, as engaging speed varies, the area under the nondimensional load-stroke diagram will also vary. For the purpose of making use of the nondimensional load-stroke diagram as general as possible, the area under the diagram was made constant. Therefore, it is exact only for one value of engaging speed and thrust. The engaging speed selected was the maximum allowable for the gear or 130 knots for the Mk7-1 and 135 knots for the Mk7-2, and the thrust selected was 0.4W. Arrestments made at engaging speeds and thrusts other than these must account for area change by application of the thrust and engaging speed correction factors given in Figures F1.9 and F1.31. The nondimensional loads (and dimensioned arresting force) change in direct proportion to the area change. Areas were determined using thrust values of .4W acting as a constant during shipbased arresting runout and by subtracting values of rolling friction of k_1 WR and aerodynamic drag of

$$k_2 \int_0^R \dot{x}^2 \, dx$$

where R = total arresting runout ~ feet

dx = differential runout interval ~ feet

$\dot{x}$ = aircraft instantaneous velocity at differential runout interval ~ ft/sec

W = aircraft recovery weight ~ lbs

k_1 = rolling friction constant = .017

k_2 = aerodynamic drag factor

$$= 0.011 + 2.2 \times 10^{-6} \, W \sim \frac{\text{lbs - sec}^2}{\text{ft}^2}$$

From this, areas of 0.54 and 0.55 were obtained for the Mk7-1 and Mk7-2 arresting gears, respectively.

F4.1.2 Nondimensional Load-Stroke Diagrams - Derivation Of

The load-stroke diagram is formed from statistical analysis of substantial numbers of individual nondimensional diagrams normalized to the same base. Slices are made at frequent intervals of nondimensional stroke to obtain load variation at that point. Curves are fitted

through the mean, upper and lower 90-90 probability points to establish the load variation envelope. A finite area is required under a diagram to satisfy a constant energy base. It should be noted that a multitude of diagrams can be drawn within the envelope boundaries, each satisfying the constant area requirement. For simplicity and standardization the upper 90-90 probability diagram is formed following the envelope upper boundary during the first portion of the stroke, but crossing over and picking up the envelope lower boundary during a latter stroke to satisfy the area requirement. The lower 90-90 probability diagram is defined as the reverse of this. Because of this, in some cases the maximum load may occur on the "lower" diagram. For clarification, the maximum load is defined as the highest value of nondimensional load occurring on either diagram or on a connecting line. Connecting lines are used to completely describe the 90-90 probability envelope boundaries. Figure F1.5 shows the significance of the connecting line with the upper 90-90 peak load occurring on it.

F4.1.3 Standard Data Presented

Nondimensional load-stroke diagrams are given (in graphical form) for recovery weights ranging from 10,000 to 60,000 lbs. Diagram shape as a function of aircraft recovery weight is given in Figures F1.1 through F1.7 for the Mk7-1 and in Figures F1.21 through F1.27 for the Mk7-2 shipbased arresting gears.

A dimensioned load scale is given on each diagram for the purpose of readily obtaining dimensioned load values. As described in paragraph F4.1.1, the diagram area has a base engaging speed and a base thrust. To obtain a dimensioned value for other engaging speeds and thrust values, adjustment is required per:

$V_E^2/V_{E_{base}}^2$ x thrust and engaging speed correction factor x dimensioned scale

where V_E is engaging speed of case under consideration in knots

$V_{E_{base}}$ is the base engaging speed in knots

Average amplitude and frequency of nondimensional arresting force oscillation is given for the Mk7-1 in Figure 1.8 and for the Mk7-2 in Figure 1.30. Dimensioned amplitude (kips) and frequency (hertz) are also given on the same diagrams.

F4.1.4 Diagram Function

The nondimensional load-stroke diagram directly shows the efficiency of the arresting gear. The peak to mean ratio for any value of stroke (diagram abscissa) is obtained by simply multiplying the nondimensional load (diagram ordinate) by 2.

The nordimensional diagram permits a dimensioned load (lbs) and stroke (ft) or load (lbs) and time (sec) curve to be described for aircraft weights and engaging speeds within the ranges given on page F2. Straight line interpolation is made between the diagrams to obtain nondimensional load values for intermediate weights.

When an arresting force time-history is desired, the abscissa (time) is obtained using the relationship of nondimensional stroke, time, engaging speed and recovery weight given in Figures F1.13 and F1.35 for the Mk7-1 and Mk7-2 arresting gears, respectively.

The ordinate (force) also can be obtained by conversion of the nondimensional load to a dimensioned load (lbs), as shown on pages 27, 36, and 37 in the main body of this report, using the known values of runout, engaging speed, and airplane weight.

F4.1.5 Deviation From Base Condition.

All the nondimensional load-stroke curves given in this report are formed based on the thrust, aerodynamic drag, and rolling friction values given in paragraph F4.1.1. Any deviation from the base condition requires correction. In a dynamic analysis which calculates these for a particular aircraft, the correct arresting load can be obtained using

$$FH_C = FH - (\overline{AD}_C - \overline{AD}_B) - (\overline{RF}_C - \overline{RF}_B) + (T_C - T_B)$$

where W = aircraft weight in pounds

V = instantaneous aircraft velocity in feet per second

FH = instantaneous arresting force (as calculated using nondimensional load-stroke diagram) in pounds

FH_C = instantaneous corrected arresting force (calculated for a particular aircraft) in pounds

$\overline{AD}_B$ = base instantaneous aerodynamic drag $(.011 + 2.2 \times 10^{-6} W)V^2$ in pounds

$\overline{AD}_C$ = instantaneous aerodynamic drag (calculated for a particular aircraft) in pounds

$\overline{RF}_B$ = base instantaneous rolling friction (.017 W) in pounds

$\overline{RF}_C$ = instantaneous rolling friction (calculated for a particular aircraft) in pounds

T_B = instantaneous base thrust (.4W) in pounds

T_C = instantaneous thrust (calculated for a particular aircraft) in pounds

F4.2 Peak Arresting Force

The peak load attained during any arrestment is given as a function of aircraft recovery weight and engaging speed. The upper 90-90 (maximum) value of peak load including load oscillation, attained during recovery is given in Figures F1.11 and F1.33 for the Mk7-1 and Mk7-2 arresting gears respectively. The expected (mean) values of such loads are given for the same gears in Figures F1.12 and F1.34. The limit or maximum load permitted on the arresting gear is shown as the load at the intersection of the gear limit capacity lines. Limit capacity, as a function of aircraft weight and engaging speed is given in Figures F1.10 and F1.32 for the Mk7-1 and Mk7-2 arresting gears.

These same loads shown in Figures F1.11, F1.12, F1.33 and F1.34 can be obtained by dimensioning the peak load given on the nondimensional diagrams for a particular recovery weight and engaging speed.

F4.3 Effects of Various Physical Parameters on the Shape of the Load-Stroke Diagram

The load-stroke diagrams given for the Mk7-1 and Mk7-2 arresting gears in Figures F1.1 through F1.7 and F1.23 through F1.29 reflect the loading characteristics of these gears that are to be expected during normal arrested landing operations and are therefore to be used for aircraft design. Certain physical parameters affecting the shape of the load-stroke diagram were studied for a better understanding of the loading behavior of the arresting gear. Some of these parameters occur during normal arresting operations and account for some of the loading variation observed during statistical analysis; other parameters occurring during other than normal arresting operations were also studied.

F4.3.1 The Effect of Airplane/Dead Load Arrestments

A dead load arrestment is considered to be an "other than normal" arrestment since only actual aircraft land into an arresting gear. Dead load tests are conducted primarily to assist in the design and development of an arresting gear system. Final refinement of such a system is made during tests using aircraft. Only aircraft test data was used in this program; therefore, comparisons with dead load tests are not given. Such comparisons can be made using the arresting gear data presented in the main body of this report.

F4.3.2 The Effect of On/Off Center Arrestments

Comparisons were made of the results of "on" vs. off-center arrestments. Curves showing comparisons at aircraft recovery weights of 14,000, 22,000, and 49,000 pounds for the Mk7-1 arresting gear and at 49,000 pounds for the Mk7-2 arresting gear are given in Figures F1.14 through F1.16 and F1.36 respectively. The curves presented are mean curves from statistical analysis of attenuated curves from individual arrestments. The differences observed are small and are well within the tolerance limit boundary of load variation. Therefore, the effect of off-center arrestments on the shape of the attenuated load-

stroke diagram is considered insignificant. Considerable effect was found in the amplitude of the oscillatory curve which is greater for off-center arrestments into the Mk7-1 gear. This effect is shown in Figures F1.18 through F1.20 for Mk7-1 weights of 14,000, 22,000, and pounds respectively. No significant difference was found in the amplitude of the oscillatory curve of "on" vs. off-center Mk7-2 arrestments. Frequency comparisions were observed to be close for both gears; therefore, the effect of off-center arrestments on load oscillation frequency is considered negligible. Comparisions are not given at other weights due to unavaiability of adequate 20 ft. off-center data at those weights.

F4.3.3 The Effect of Heavy (1 7/16 inch) vs. Regular (1 3/8 inch) Diameter Purchase Cable

Evaluation of the effect of the new heavier 1 7/16 inch diameter arresting purchase cable on the loading characteristics of the Mk7-1 arresting gear was made by:

1. Comparing attenuated mean diagrams from data weight bands of the two size cables

2. Comparing amplitude and frequency of oscillation from data weight bands of the two cable sizes

The comparisons of item 1 (above) are given in Figures F1.20 and F1.21 for recovery weights of 14,000 lbs and 49,000 lbs. The loading differences at these (and other) weights are quite small and certainly within the tolerance limit boundary of load variation; therefore, no significant loading trend was observed.

In comparing the amplitude and frequency of oscillation, the only difference of any significance observed was in the amplitude of load oscillation at a recovery weight of 14,000 lbs. In comparing averages of 26 on center 1 3/8 inch diameter samples with 21 on center 1 7/16 inch diameter samples, given in Figure F1.22, the fourth cycle negative displacement and fifth cycle positive displacement of the heavier cable were noticeably larger. Such a phenomenon may be due to random cable slippage during that particular group of tests and might not be expected to always occur. At any rate the unattenuated mean load (see Figure F1.20) is diminishing at that stroke (or time) and the maximum peak load is not affected. At heavier weight bands, no such difference was noted. Therefore, the affect of the new heavier 1 7/16 inch diameter arresting cable on the loading characteristics of the Mk7-1 arresting gear is considered negligible. For that reason, the nondimensional diagrams plus other curves of the Mk7-1 arresting gear as given in Figures F1.1 through F1.13 are one and the same for either purchase cable size.

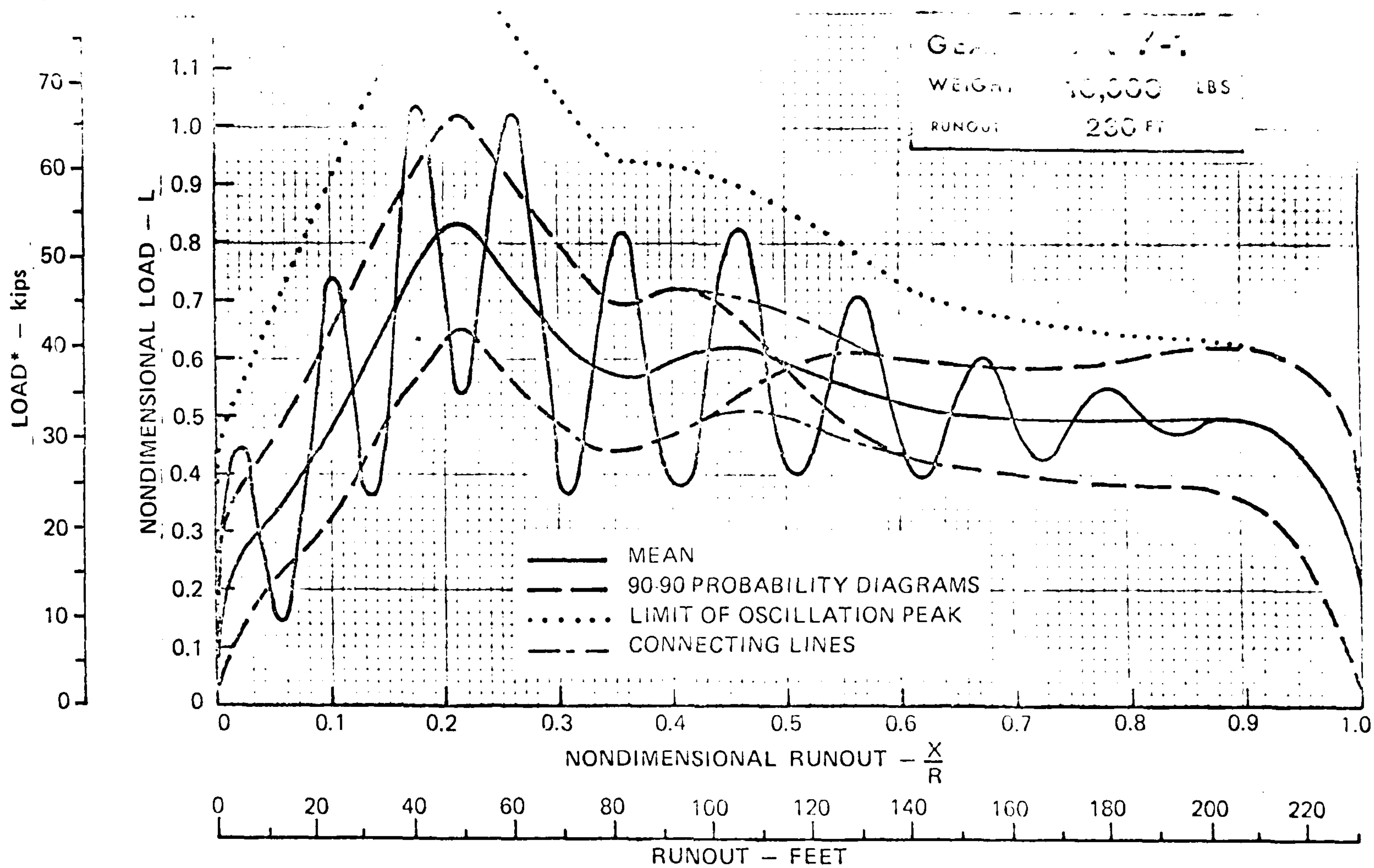
MK7-1 AND MK7-2 ARRESTING GEAR (SHIPBASED)

SUMMARY OF A ANALYZED

GEAR	SPAN (FT.)	TEST TYPE	CABLE SIZE	WEIGHT (KIPS)	ON/OFF CENTER	ENGAGING SPEED RANGE (KNOTS) <90	90-99	100 TO 109	110 TO 119	120 TO 129	130 TO 139	140 TO 149	SUB-TOTAL	SUB-TOTAL	TOTAL
MK7-2	120	A/P	1 3/8"	12	"ON"	3	4	6	9	12	3	0	37	37	
					"OFF"	0	0	0	0	0	0	0	0		
				24	"ON"	0	2	5	2	1	0	0	10	16	
					"OFF"	0	3	1	1	1	0	0	6		
				34	"ON"	6	6	9	3	0	0	0	24	34	
					"OFF"	1	4	4	1	0	0	0	10		
				37	"ON"	2	0	5	4	2	0	0	13	16	
					"OFF"	1	1	1	0	0	0	0	3		
				45	"ON"	1	1	2	5	2	0	0	11	21	
					"OFF"	1	3	2	2	1	1	0	10		
				50	"ON"	14	13	20	27	18	2	0	94	124	
					"OFF"	4	11	7	6	0	0	0	30		
	MK7-2 TOTALS					33	48	62	62	37	6	0			248
MK7-1	120	A/P	1 3/8"	14	"ON"	4	4	8	8	2	0	0	26	42	
					"OFF"	8	2	6	0	0	0	0	16		
				22	"ON"	2	3	2	5	0	1	1	14	33	
					"OFF"	6	5	3	3	2	0	0	19		
				33	"ON"	2	2	3	1	1	0	0	9	18	
					"OFF"	2	4	2	1	0	0	0	9		
				38	"ON"	11	9	8	9	7	3	0	47	49	
					"OFF"	-	1	1					2		
				49	"ON"	3	1	1	2				7	24	
					"OFF"	6	8	2	1				17		
	1 3/8" CABLE TOTALS					44	39	36	39	12	4	1			166
	120	A/P	1 7/16"	14	"ON" *	4	4	8	5					21	
				24	"ON" *	3	2	5						10	
				34	"ON" *	4	5	4	5	1				19	
				40	"ON" *	3	8	1						12	
				50	"ON" *	7	10	8	1					26	
	1 7/16" CABLE TOTALS					21	29	26	11	1					88
GRAND TOTAL						98	116	124	103	50	10	1			502

* No arrestments identified as "Off Center"

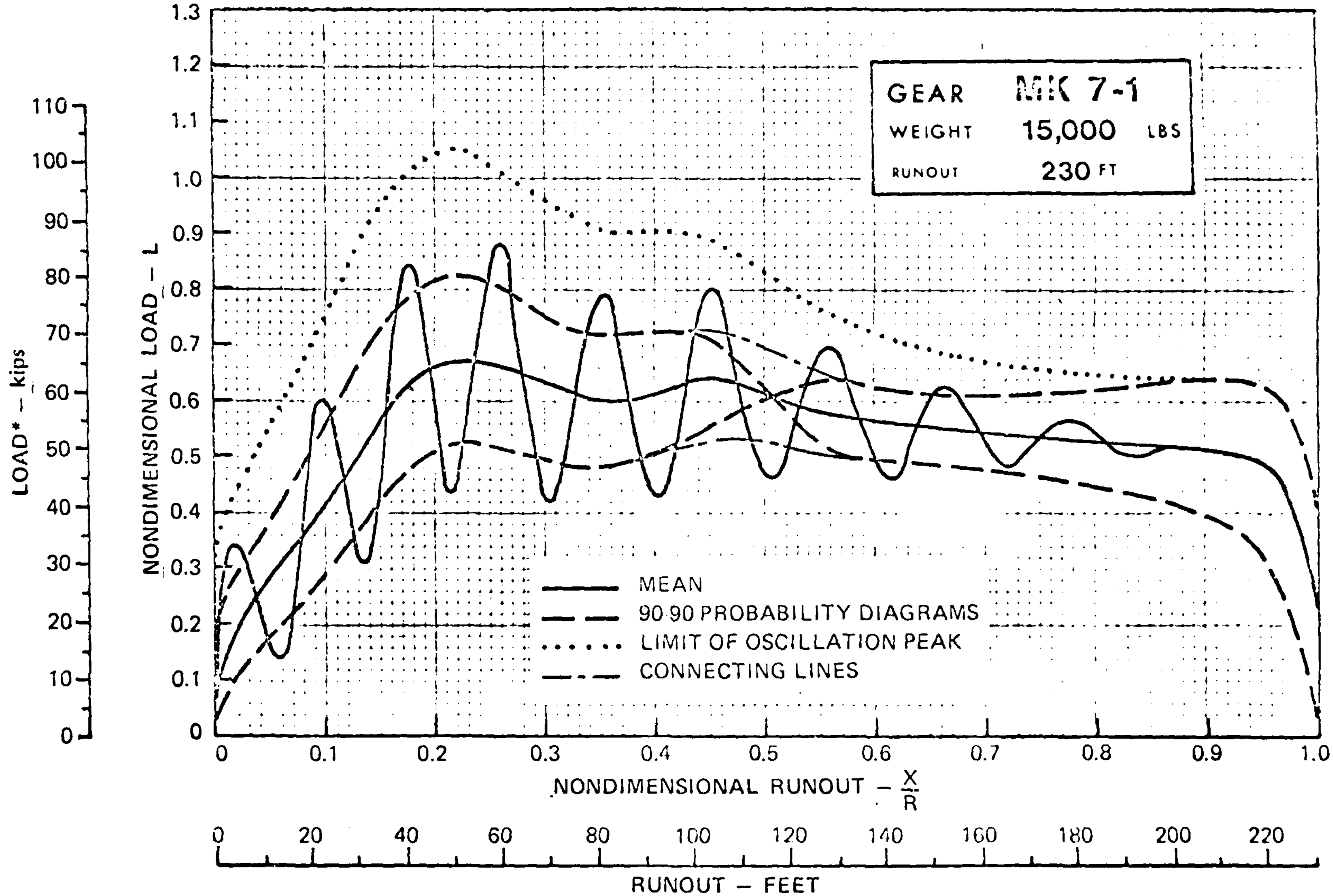
Table F1.1



*Dimensioned load scale for 130 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/130^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.1

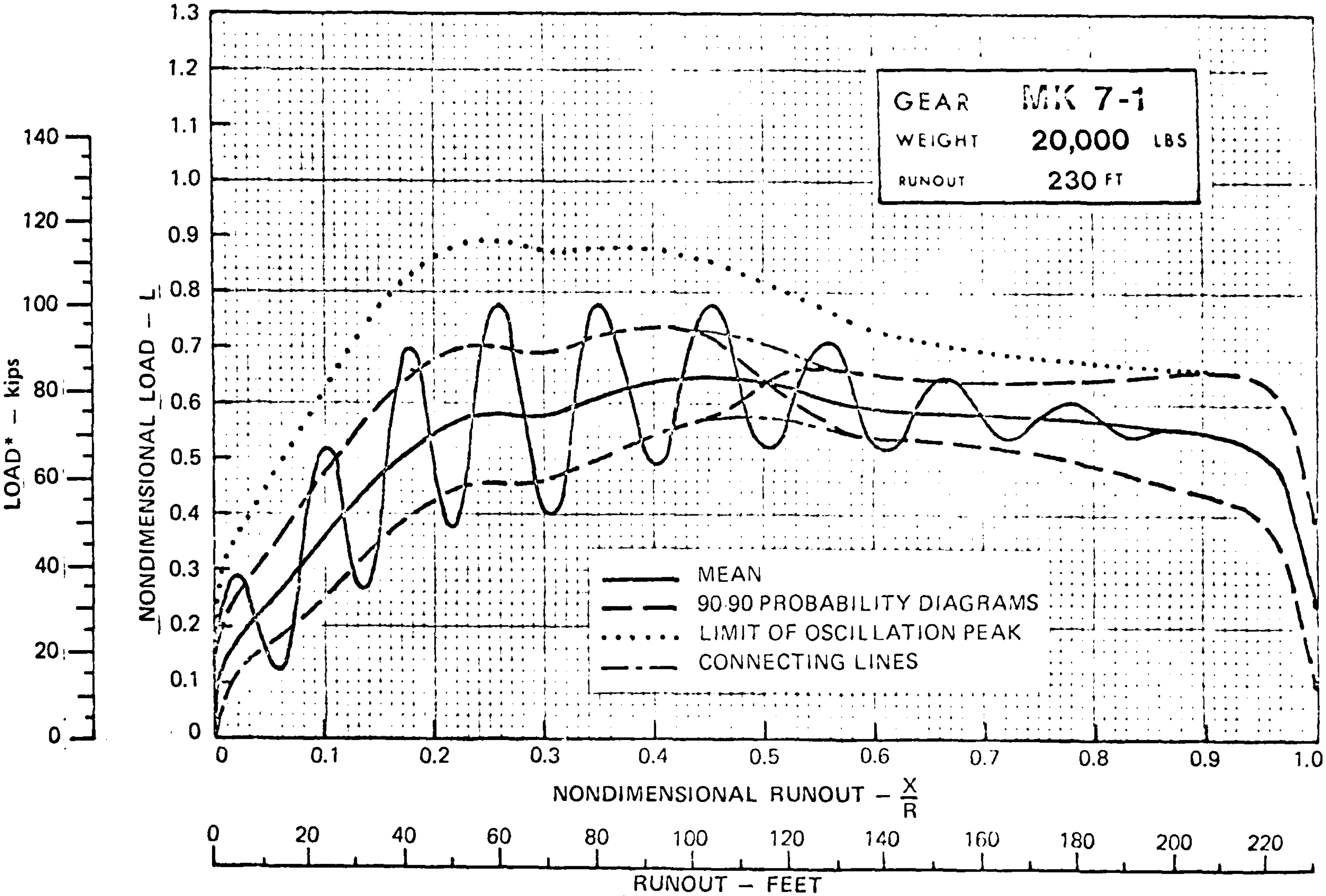
LOAD versus STROKE



*Dimensioned load scale for 130 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/130^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.2

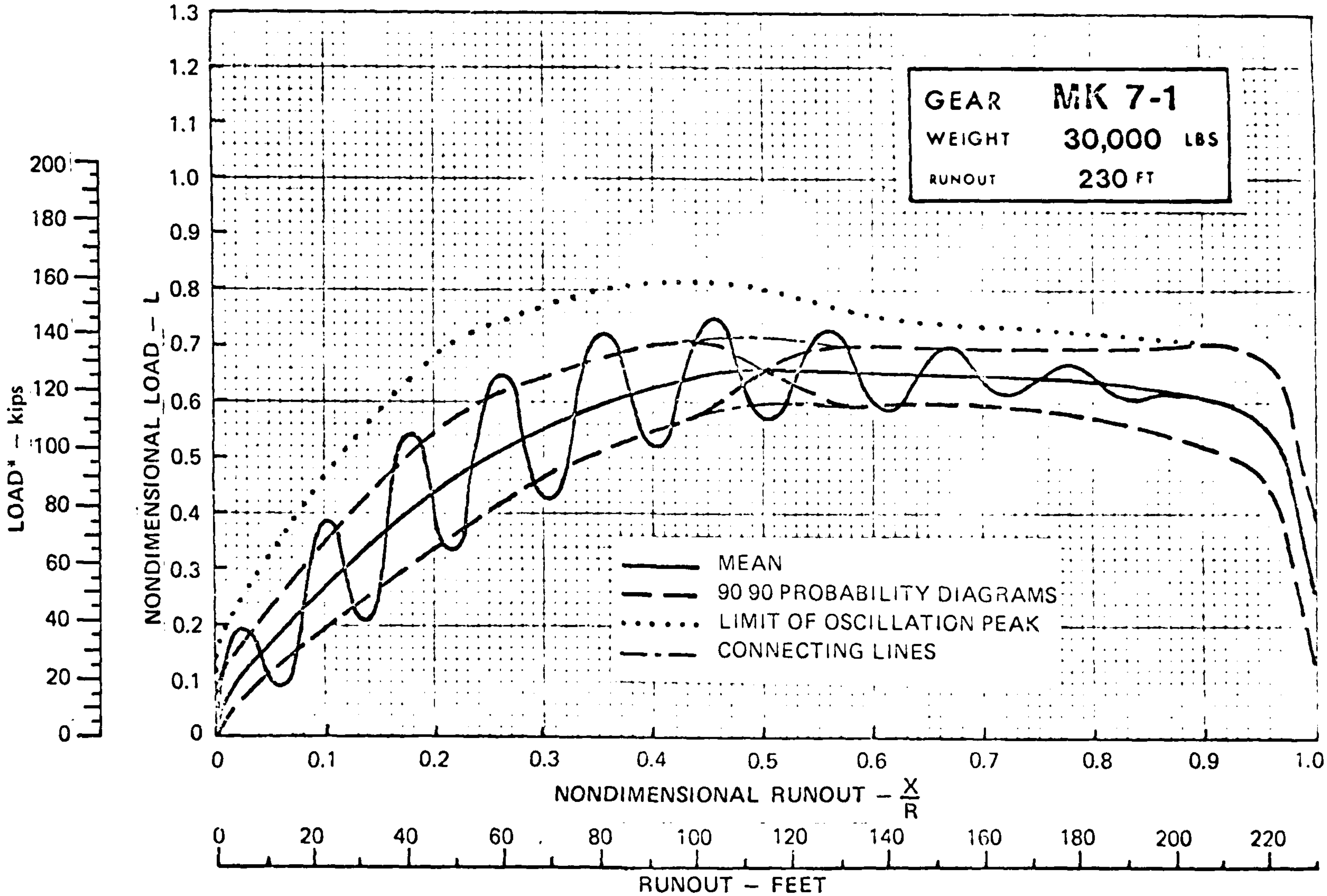
LOAD versus STROKE



*Dimensioned load scale for 130 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/130^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.3

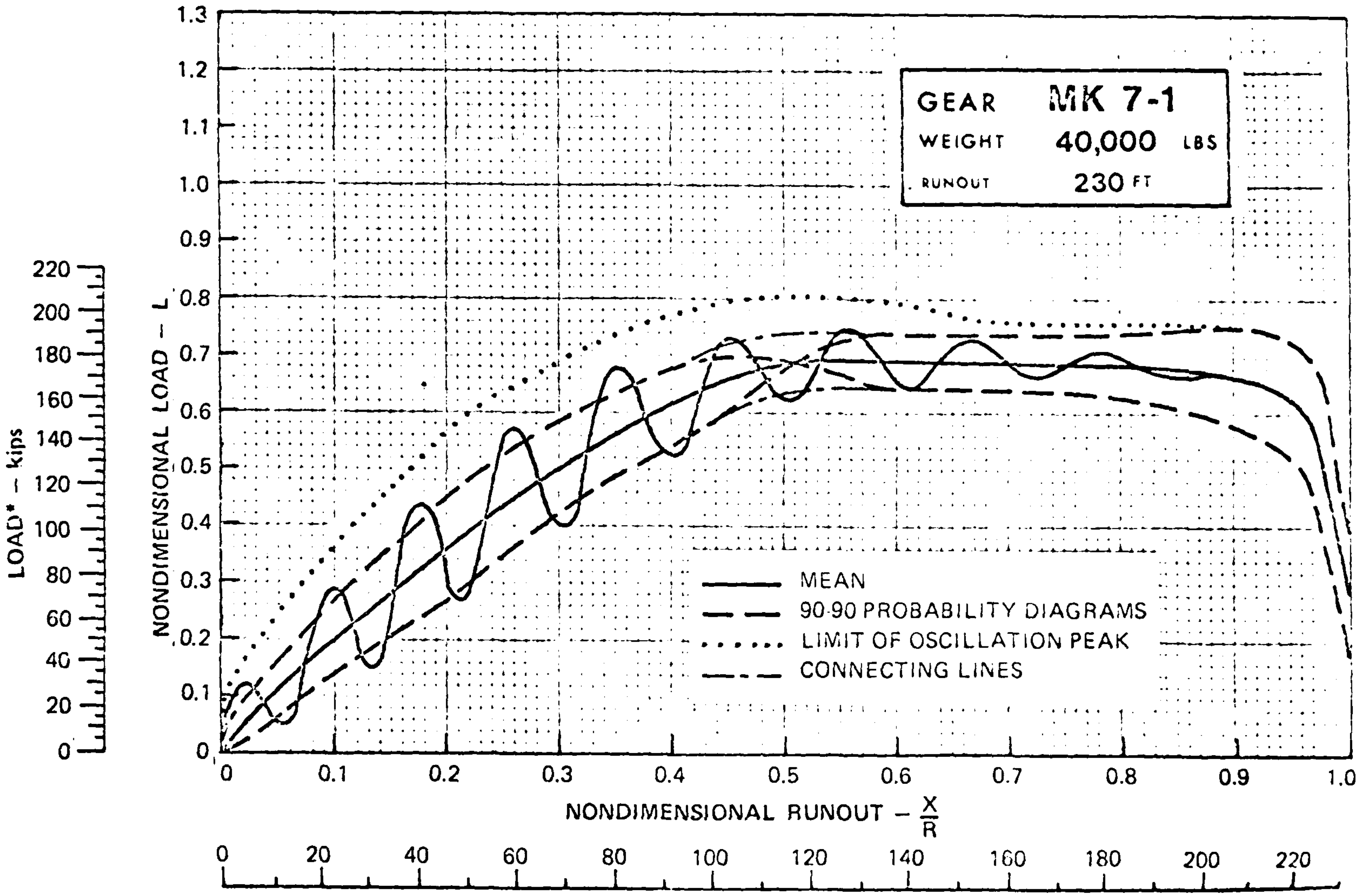
LOAD versus STROKE



*Dimensioned load scale for 130 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/130^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.4

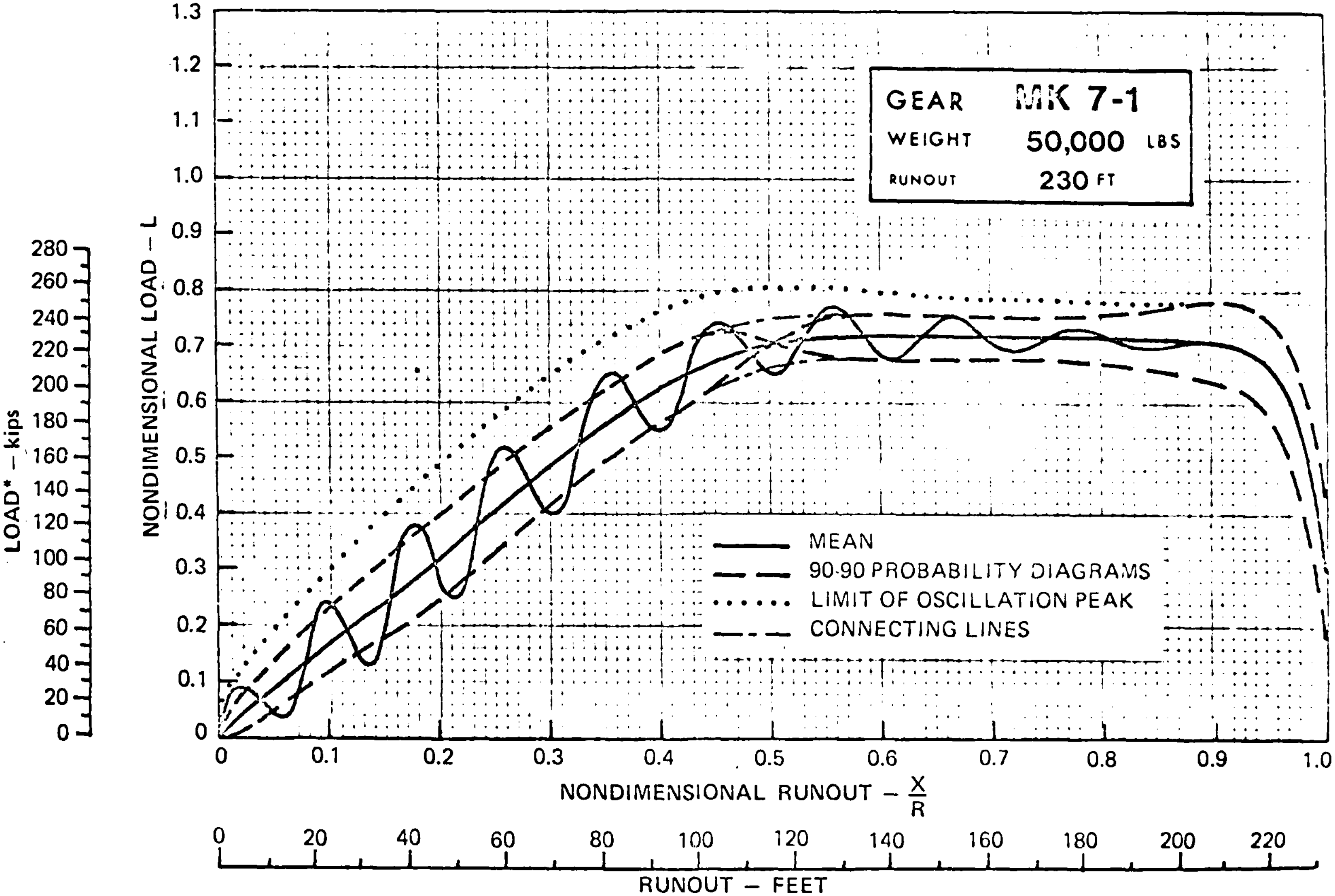
LOAD versus STROKE



*Dimensioned load scale for 130 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values [illegible] correction per ratio $V_E^2/130^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.5

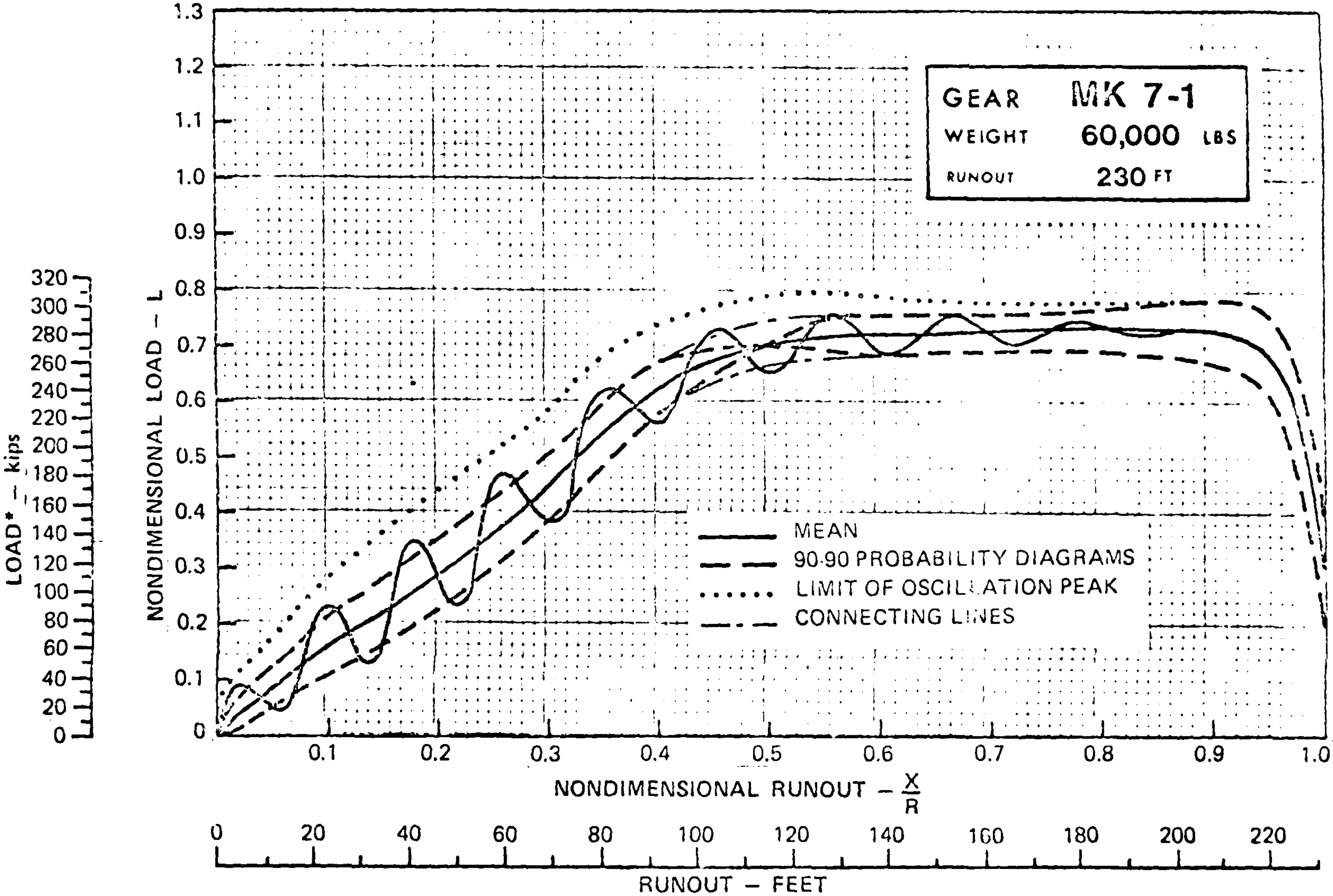
LOAD versus STROKE



*Dimensioned load scale for 130 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/130^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.6

LOAD versus STROKE

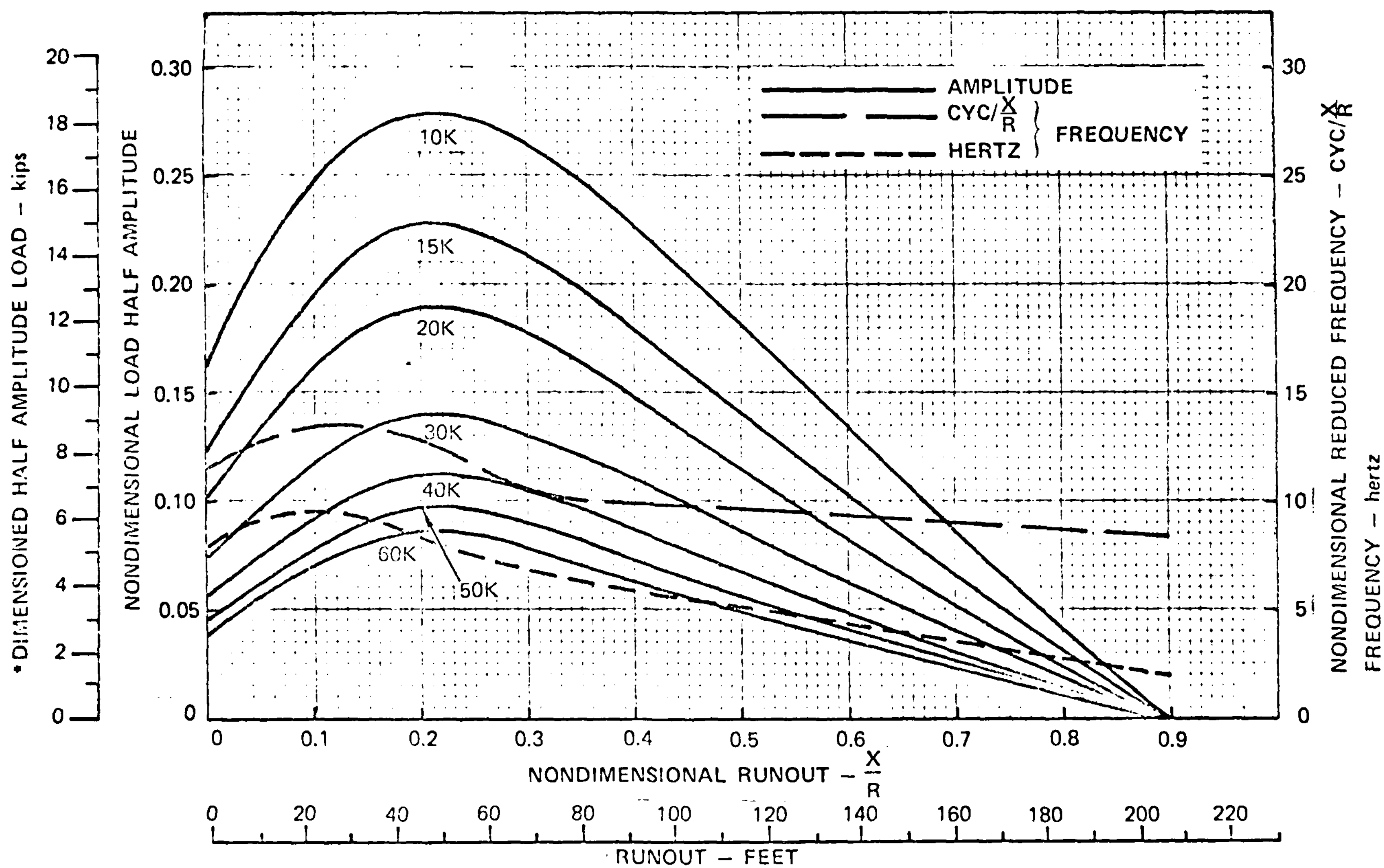


*Dimensioned load scale for 130 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/130^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.7

MK7-1 ARRESTING GEAR

AVERAGE FREQUENCY AND AMPLITUDE OF ARRESTING FORCE OSCILLATION



*Dimensioned half amplitude load scale for 10,000 lb airplane weight, 130 knot engaging speed, and 0.4W thrust only. Other weights and engaging speeds require correction per ratio $\frac{V_E^2 \times \text{weight}}{130^2 \times 10}$ x dimensioned scale x correction factor. V_E is in knots and airplane weight W is in kips.

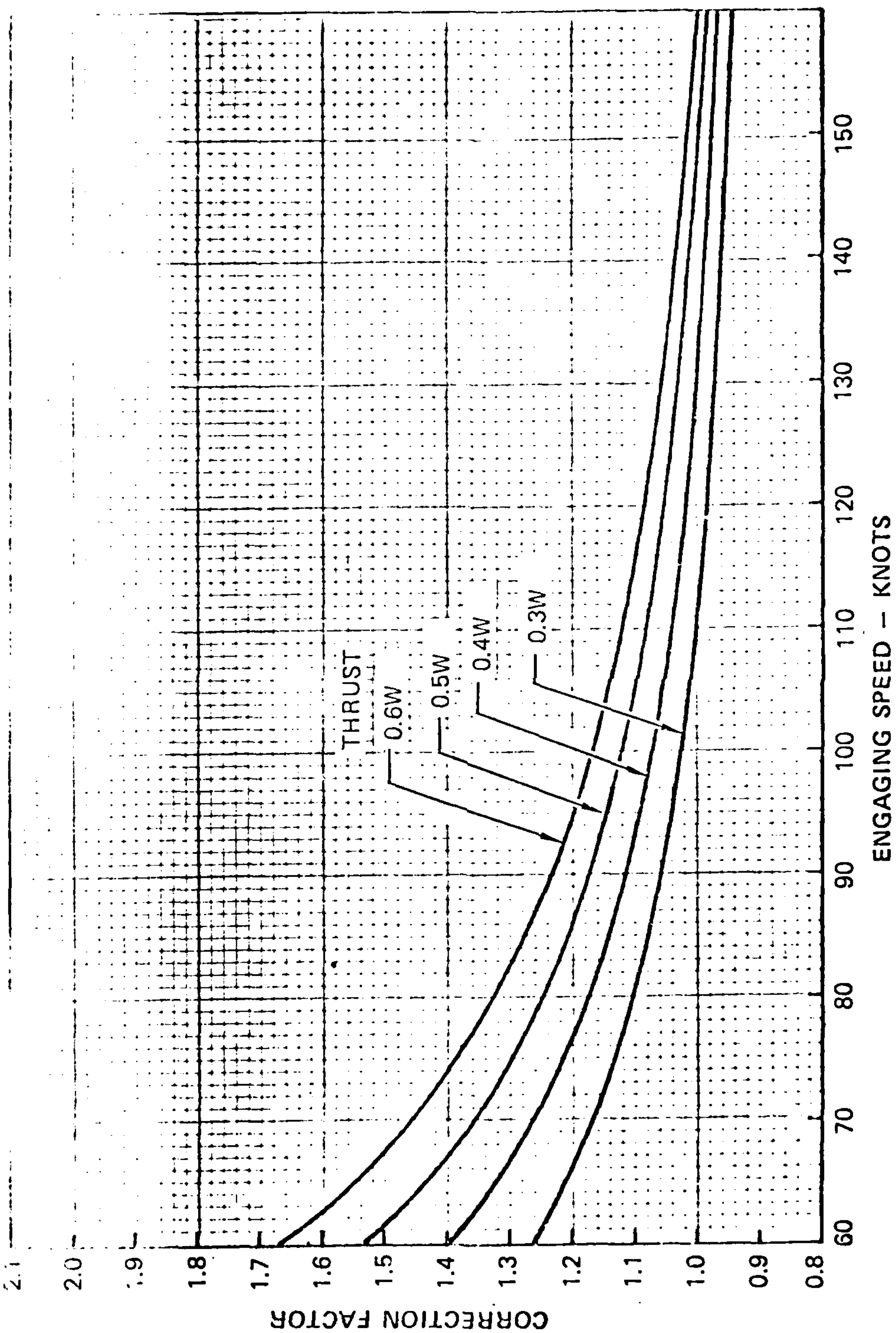

THRUST
0.6W
0.5W
0.4W
0.3W
CORRECTION FACTOR
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
ENGAGING SPEED — KNOTS
60
70
80
90
100
110
120
130
140
150

Figure F1.9

MK7-1 ARRESTING GEAR

LIMIT ENGAGING SPEED

as a function of
AIRPLANE RECOVERY WEIGHT

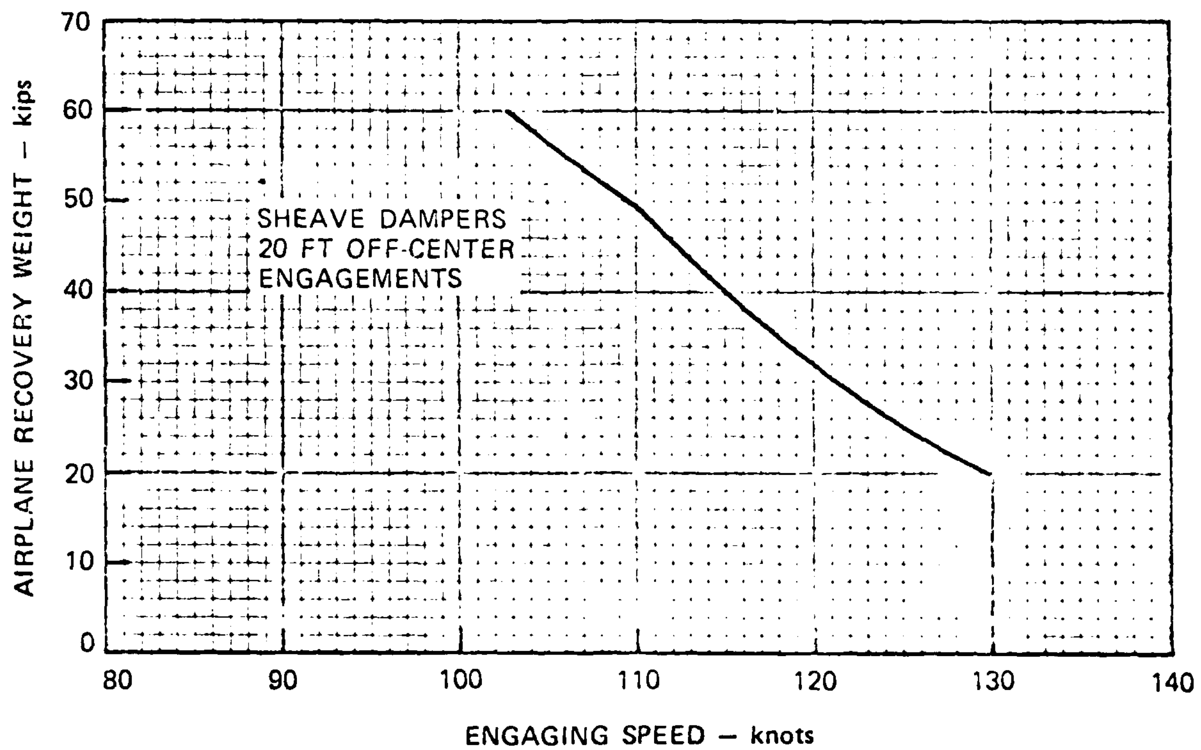


Figure F1.10

MK7-1 ARRESTING GEAR

MAXIMUM PEAK ARRESTING FORCE

AS A FUNCTION OF RECOVERY WEIGHT AND ENGAGING SPEED

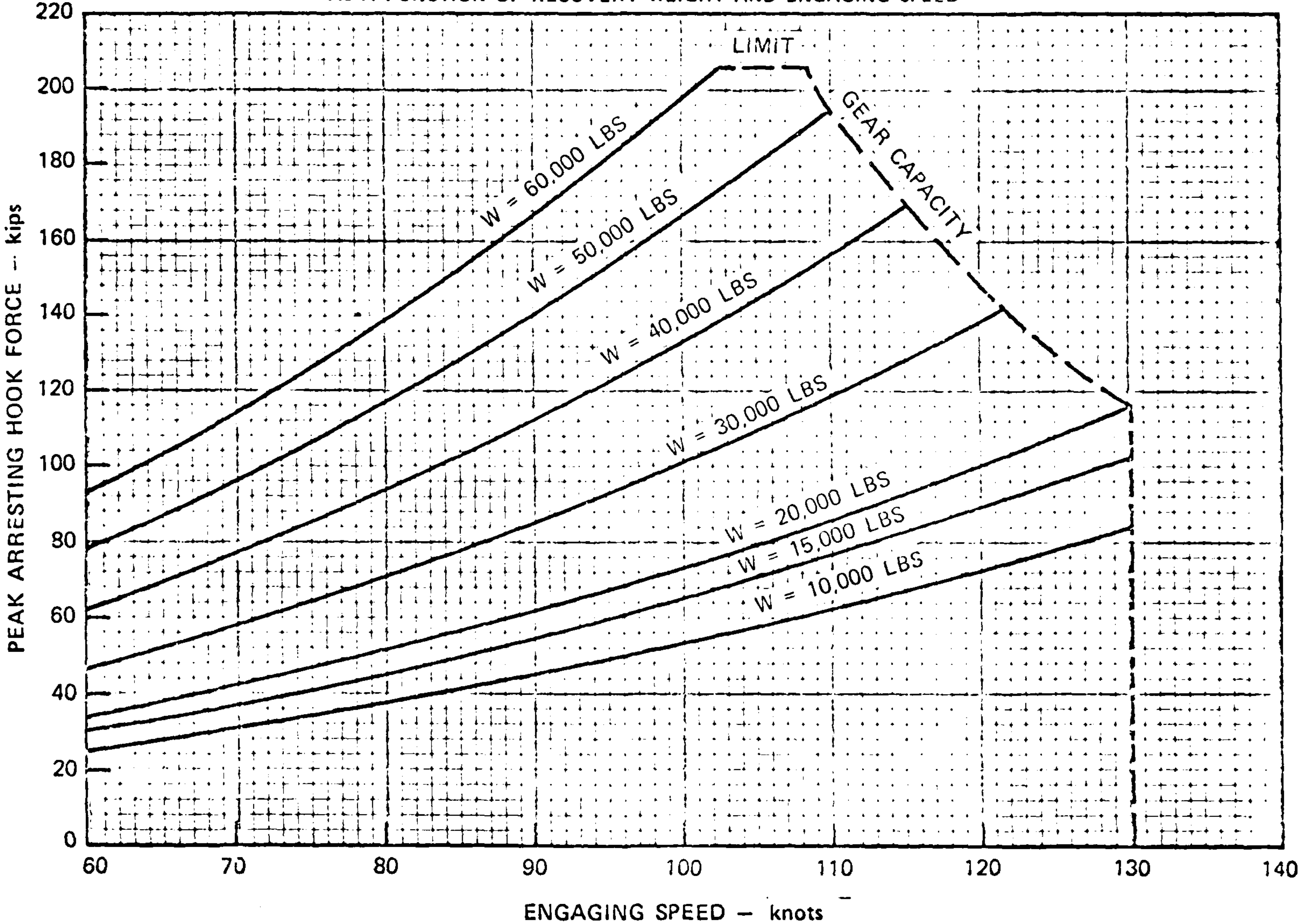


Figure F1.11

MK7-1 ARRESTING GEAR

MEAN PEAK ARRESTING FORCE

AS A FUNCTION OF RECOVERY WEIGHT AND ENGAGING SPEED

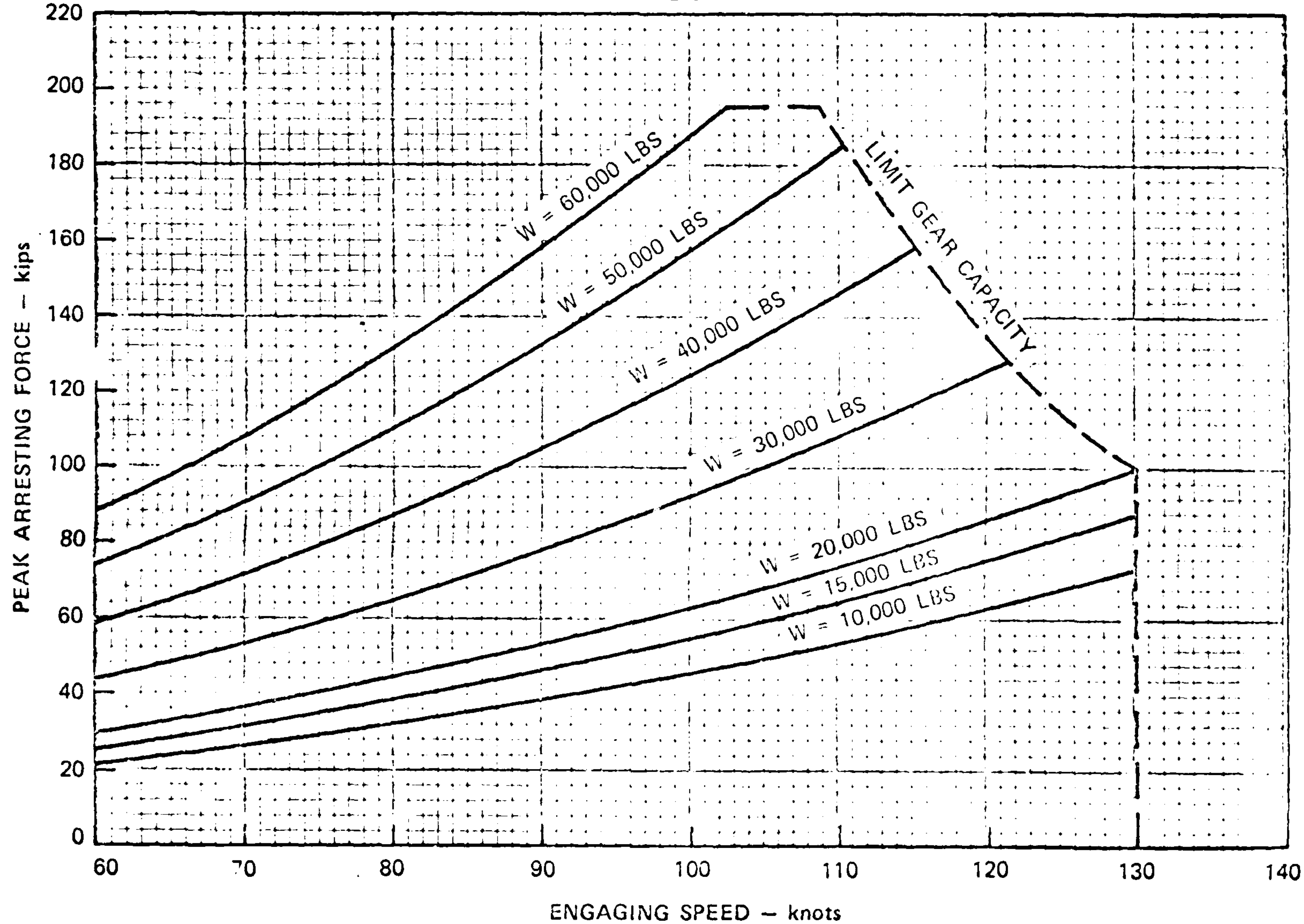


Figure F1.12

MK7-1 ARRESTING GEAR

RELATIONSHIP OF NONDIMENSIONAL STROKE, TIME, AND ENGAGING SPEED

AIRPLANE THRUST = 0.4 W (ACTING THROUGHOUT ARRESTMENT)

AIRPLANE WEIGHT RANGE = 10,000 – 60,000 LBS

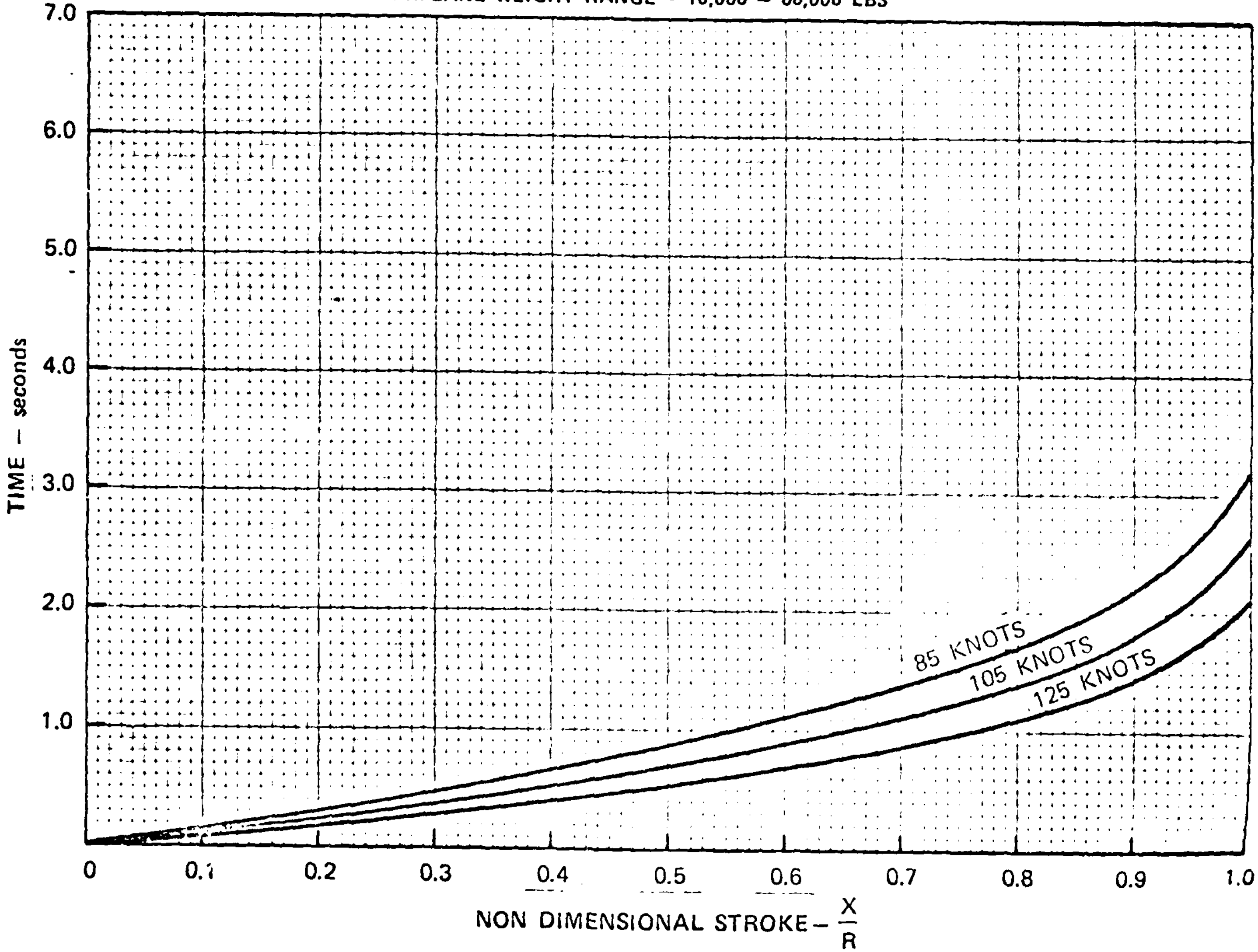


Figure F1.13

MK7-1 ARRESTING GEAR

NONDIMENSIONAL DIAGRAM SHAPE COMPARISON

RECOVERY WEIGHT = 14,000 LBS

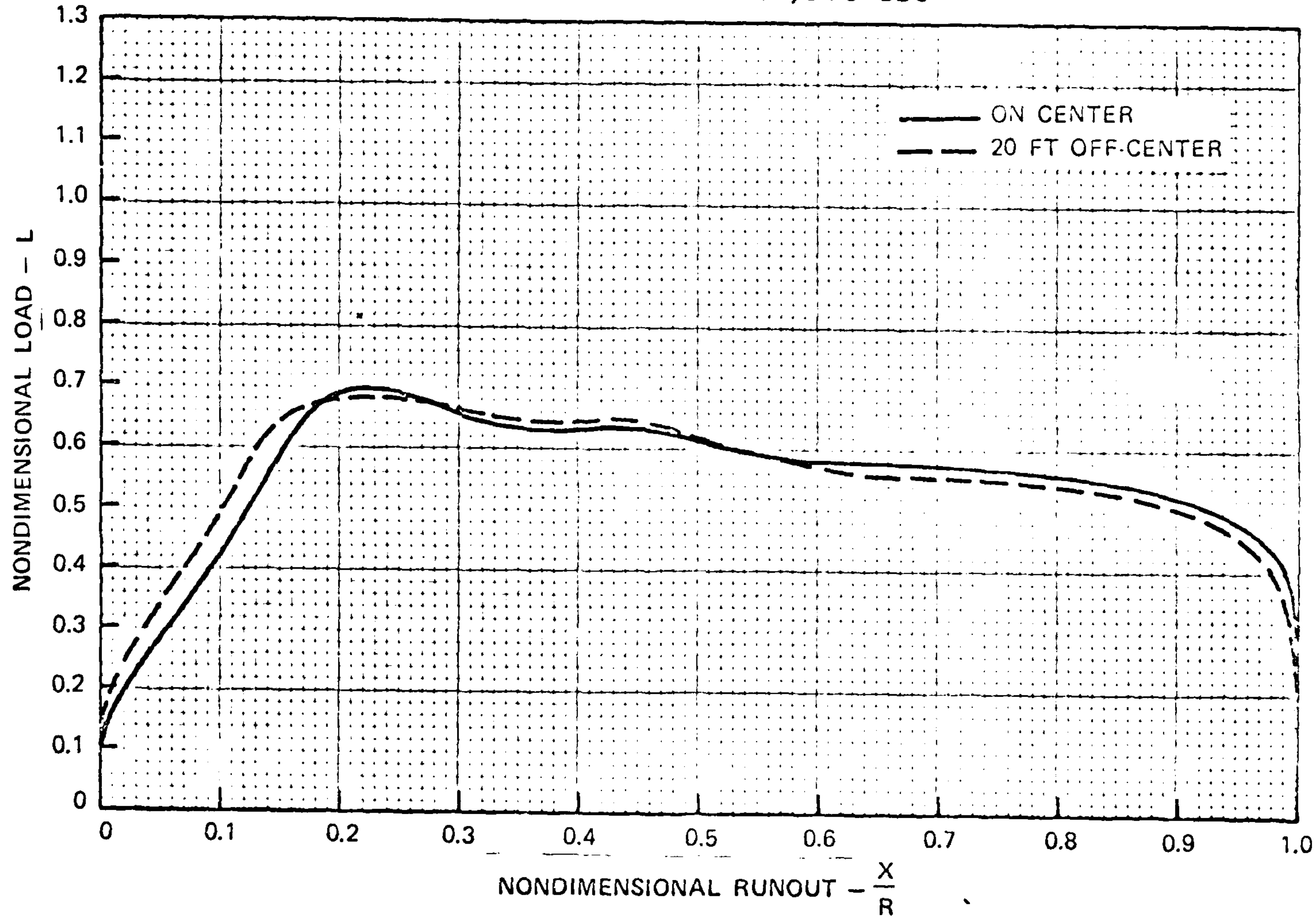


Figure F1.14

MK 7-1 ARRESTING GEAR

NONDIMENSIONAL DIAGRAM SHAPE COMPARISON

RECOVERY WEIGHT = 22,000 LBS

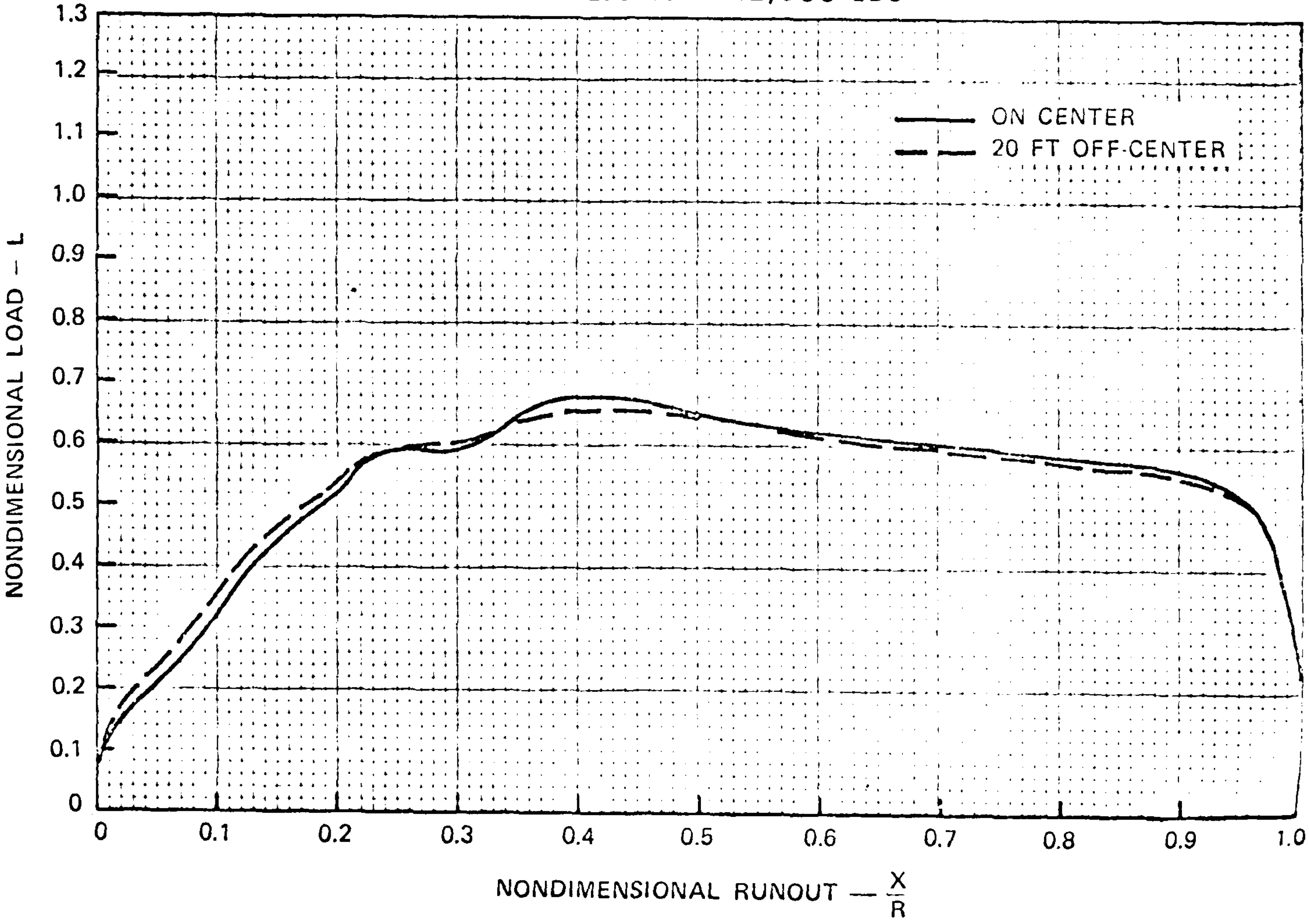


Figure F1.15

MK7-1 ARRESTING GEAR

NONDIMENSIONAL DIAGRAM SHAPE COMPARISON

RECOVERY WEIGHT = 49,000 LBS

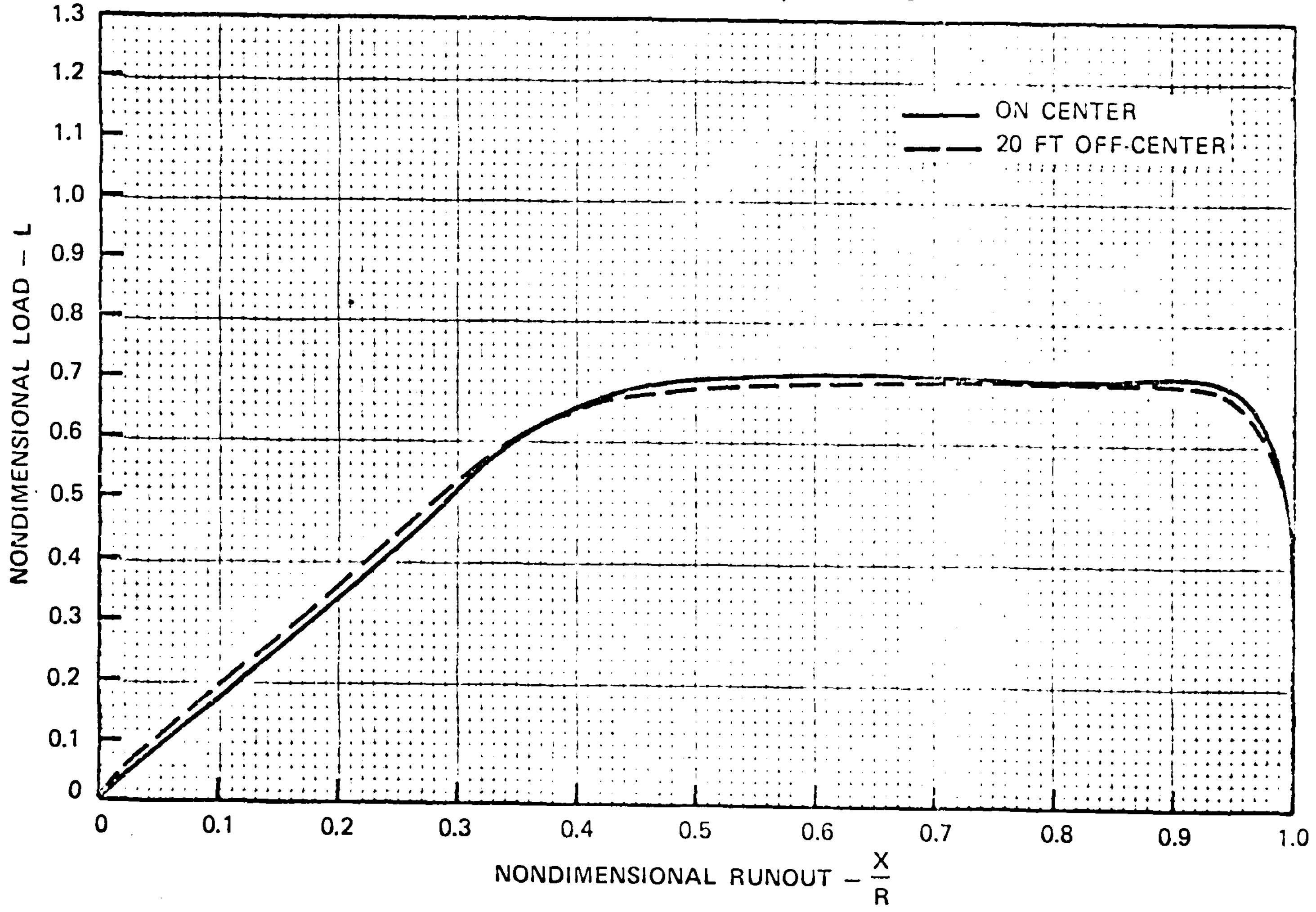


Figure F1.16

MK7-1 ARRESTING GEAR

NONDIMENSIONAL ARRESTING FORCE OSCILLATION AMPLITUDE COMPARISON

RECOVERY WEIGHT = 14,000 LBS

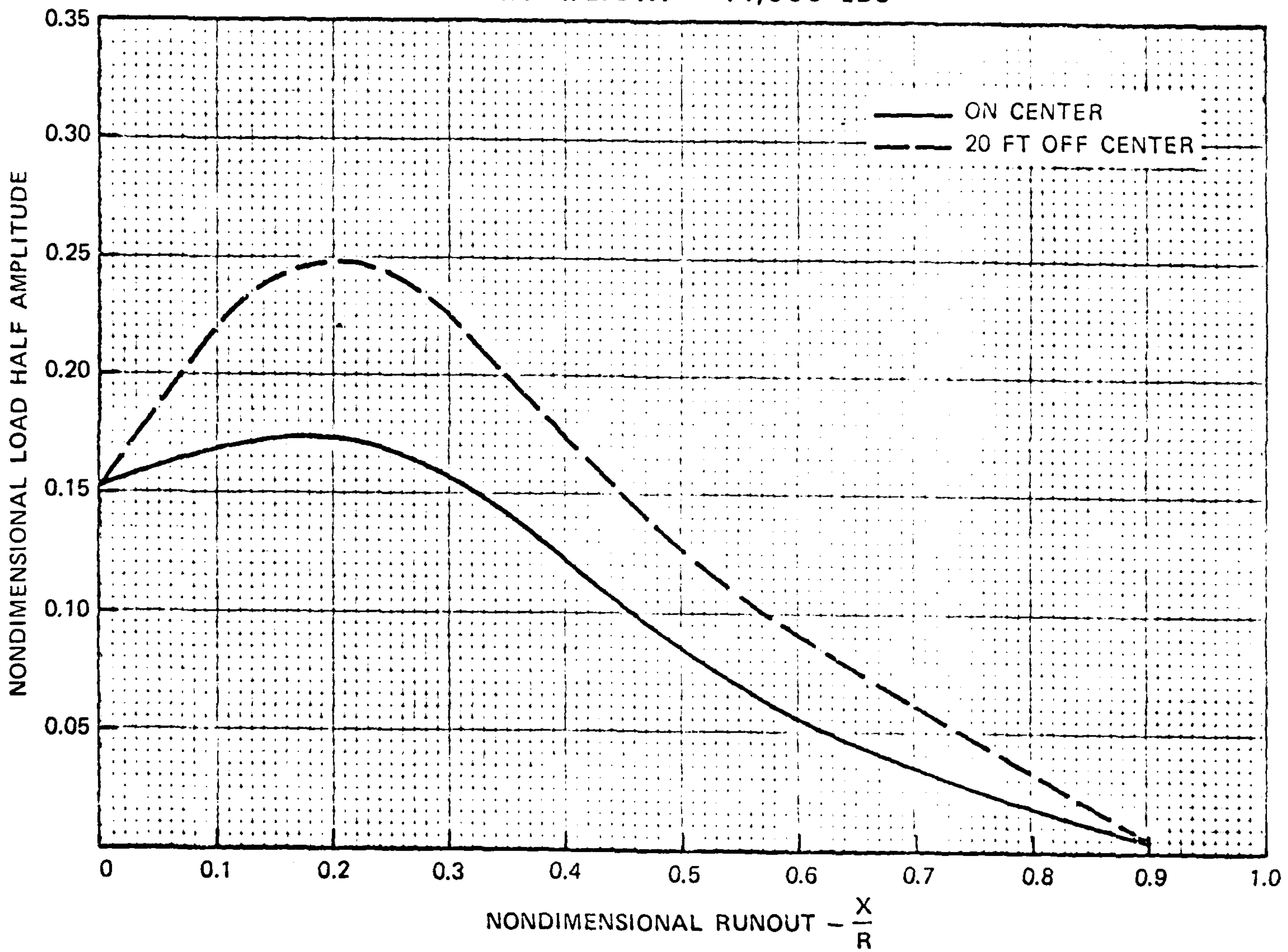


Figure F1.17

MK7-1 ARRESTING GEAR

NONDIMENSIONAL ARRESTING FORCE OSCILLATION AMPLITUDE COMPARISON

RECOVERY WEIGHT = 22,000 LBS

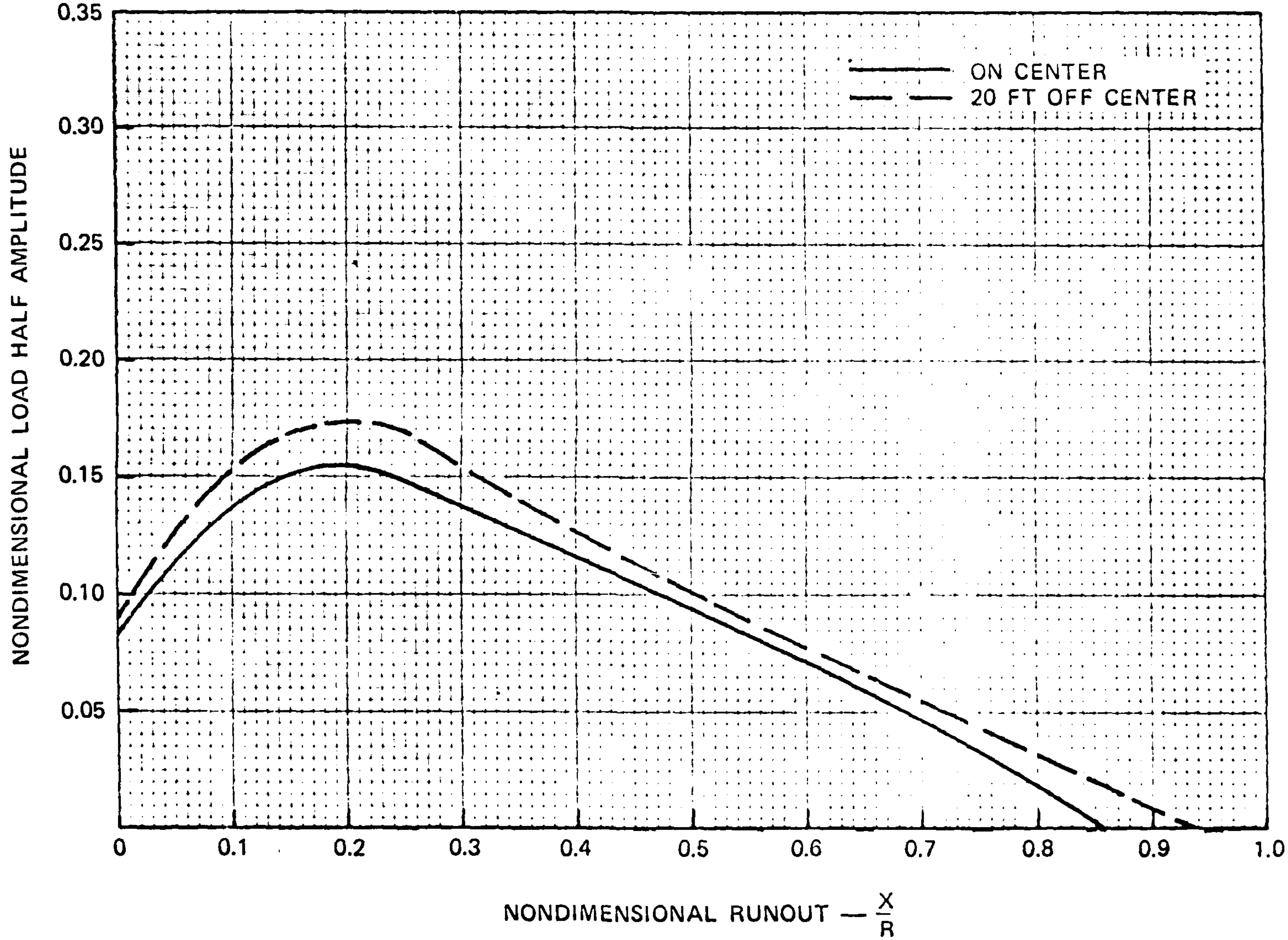


Figure F1.18

MK7-1 ARRESTING GEAR

NONDIMENSIONAL ARRESTING FORCE OSCILLATION AMPLITUDE COMPARISON

RECOVERY WEIGHT = 49,000 LBS

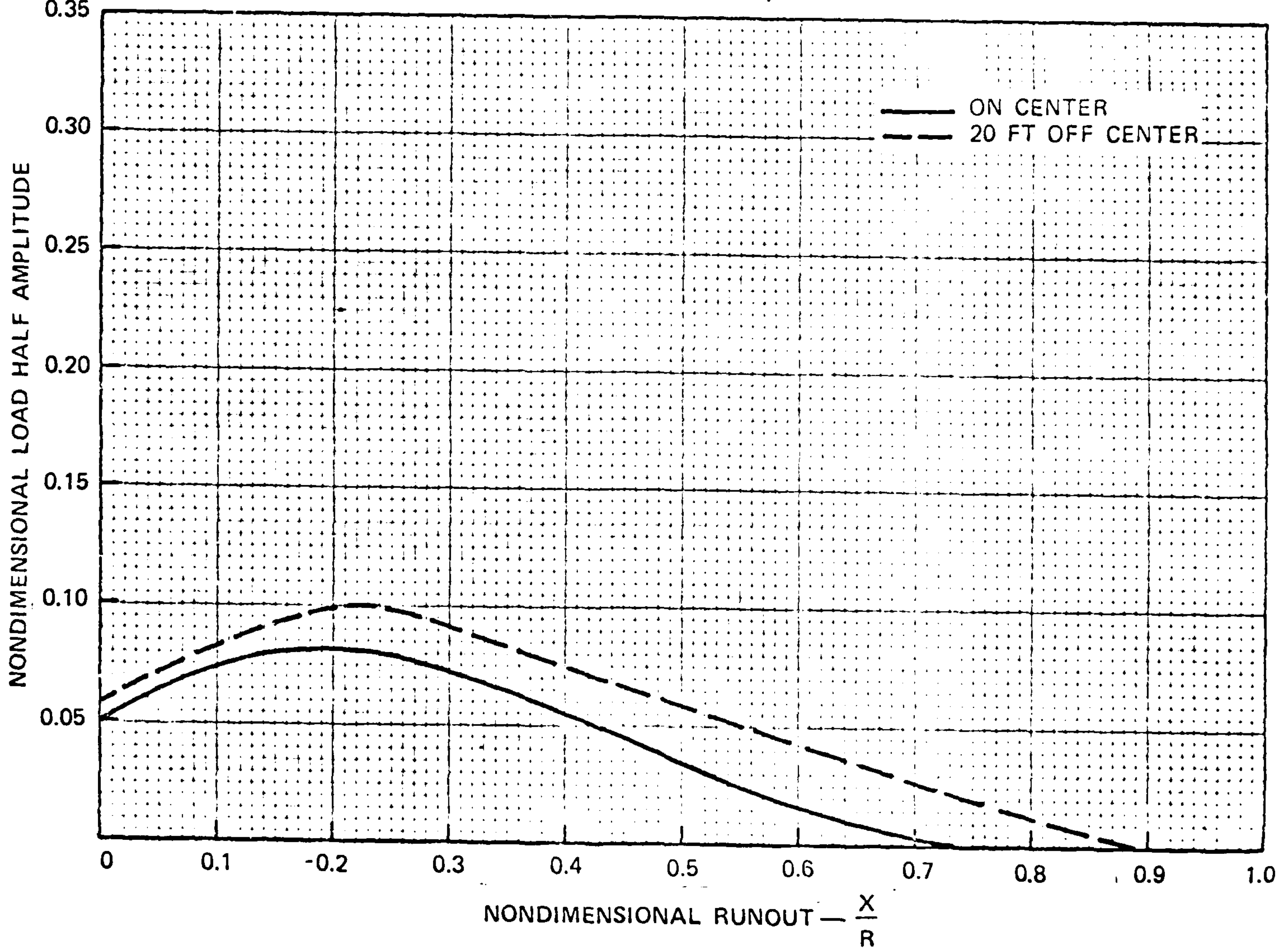


Figure F1.19

MK7-1 ARRESTING GEAR

NONDIMENSIONAL DIAGRAM SHAPE COMPARISON

RECOVERY WEIGHT = 14,000 LBS

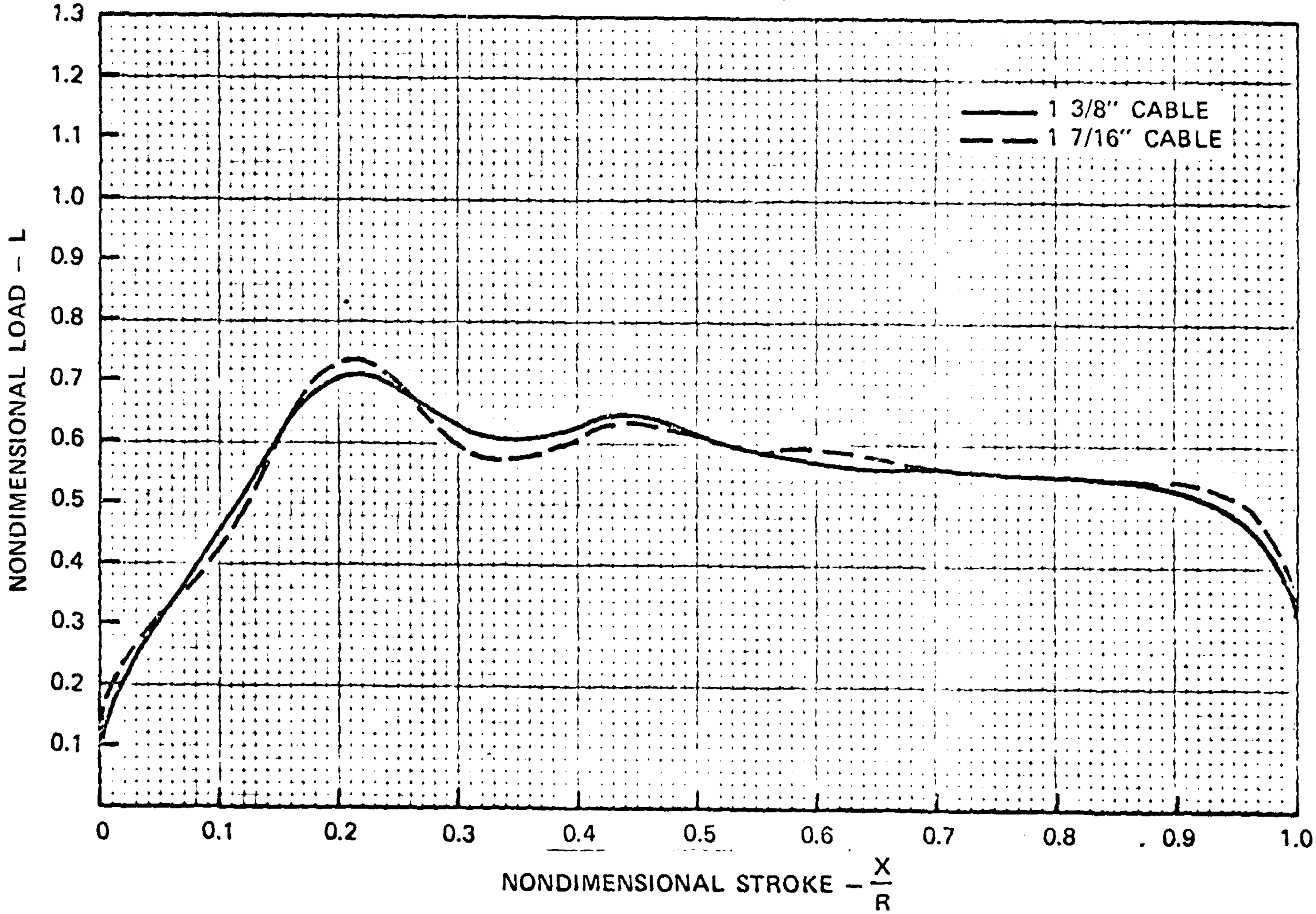
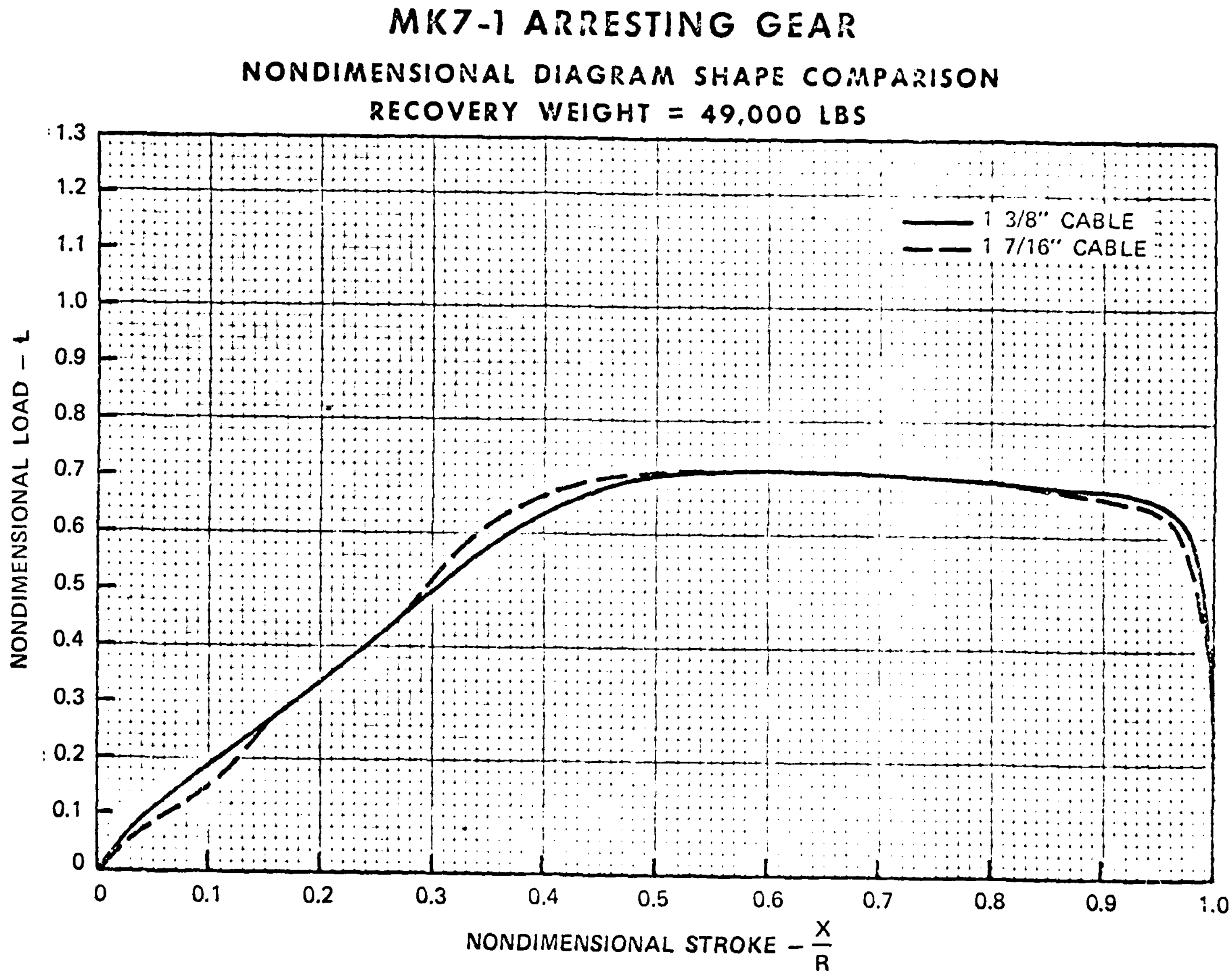
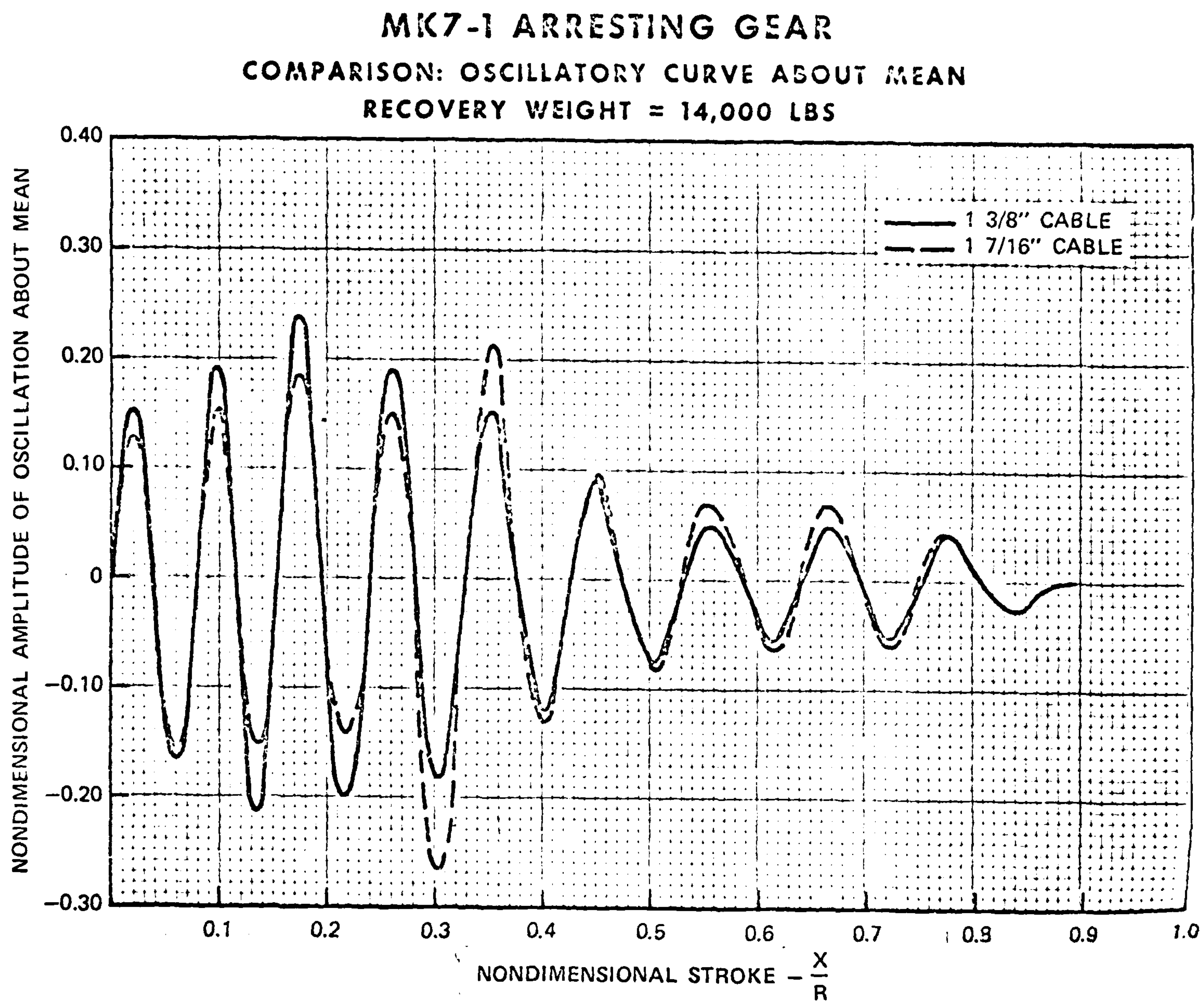


Figure F1.20

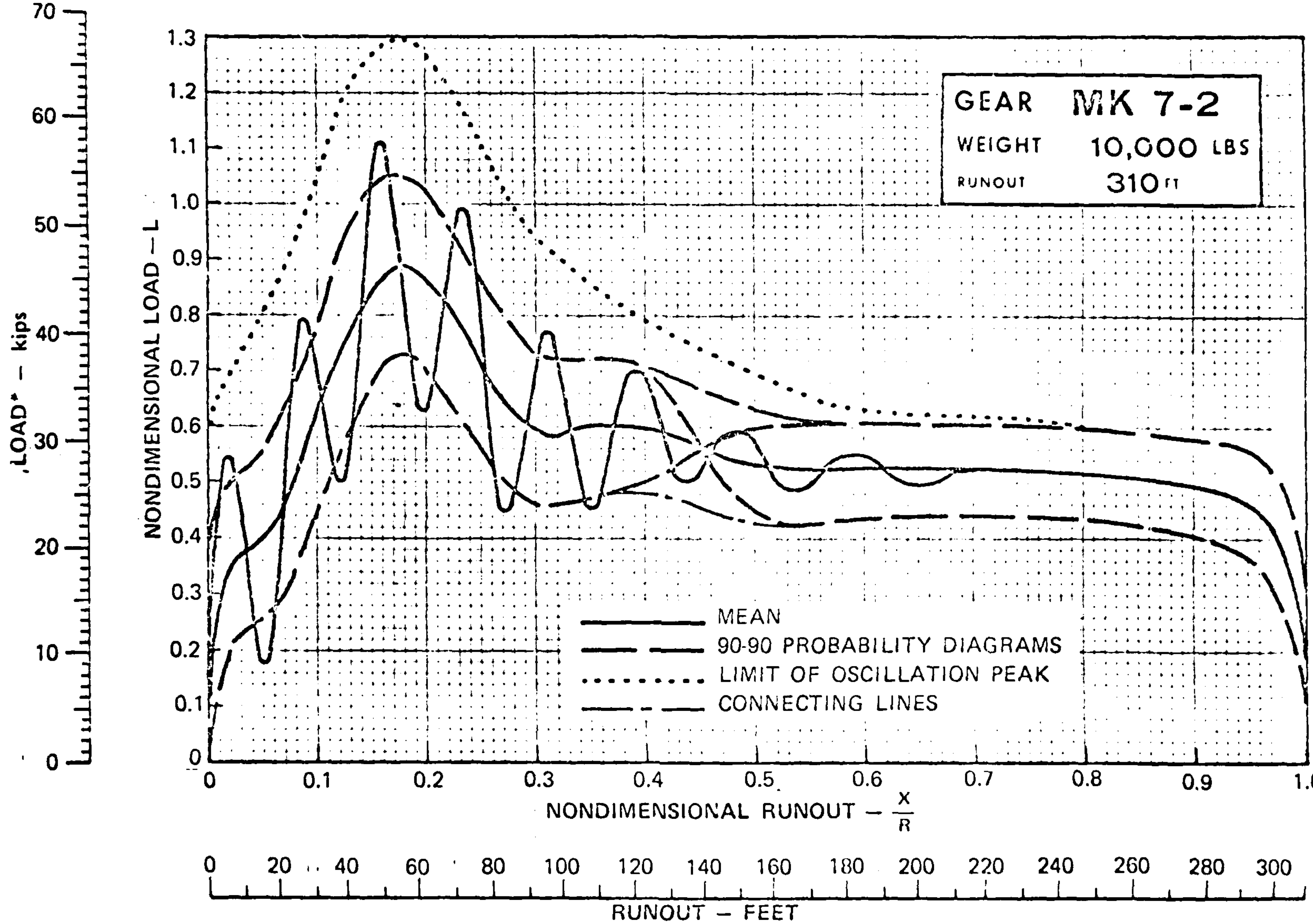

MK7-1 ARRESTING GEAR
NONDIMENSIONAL DIAGRAM SHAPE COMPARISON
RECOVERY WEIGHT = 49,000 LBS
1 3/8" CABLE
1 7/16" CABLE
NONDIMENSIONAL LOAD – L
NONDIMENSIONAL STROKE – X/R
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3



MK7-1 ARRESTING GEAR
COMPARISON: OSCILLATORY CURVE ABOUT MEAN
RECOVERY WEIGHT = 14,000 LBS
1 3/8" CABLE
1 7/16" CABLE
NONDIMENSIONAL AMPLITUDE OF OSCILLATION ABOUT MEAN
0.40
0.30
0.20
0.10
0
−0.10
−0.20
−0.30
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
NONDIMENSIONAL STROKE − X/R

Figure F1.22

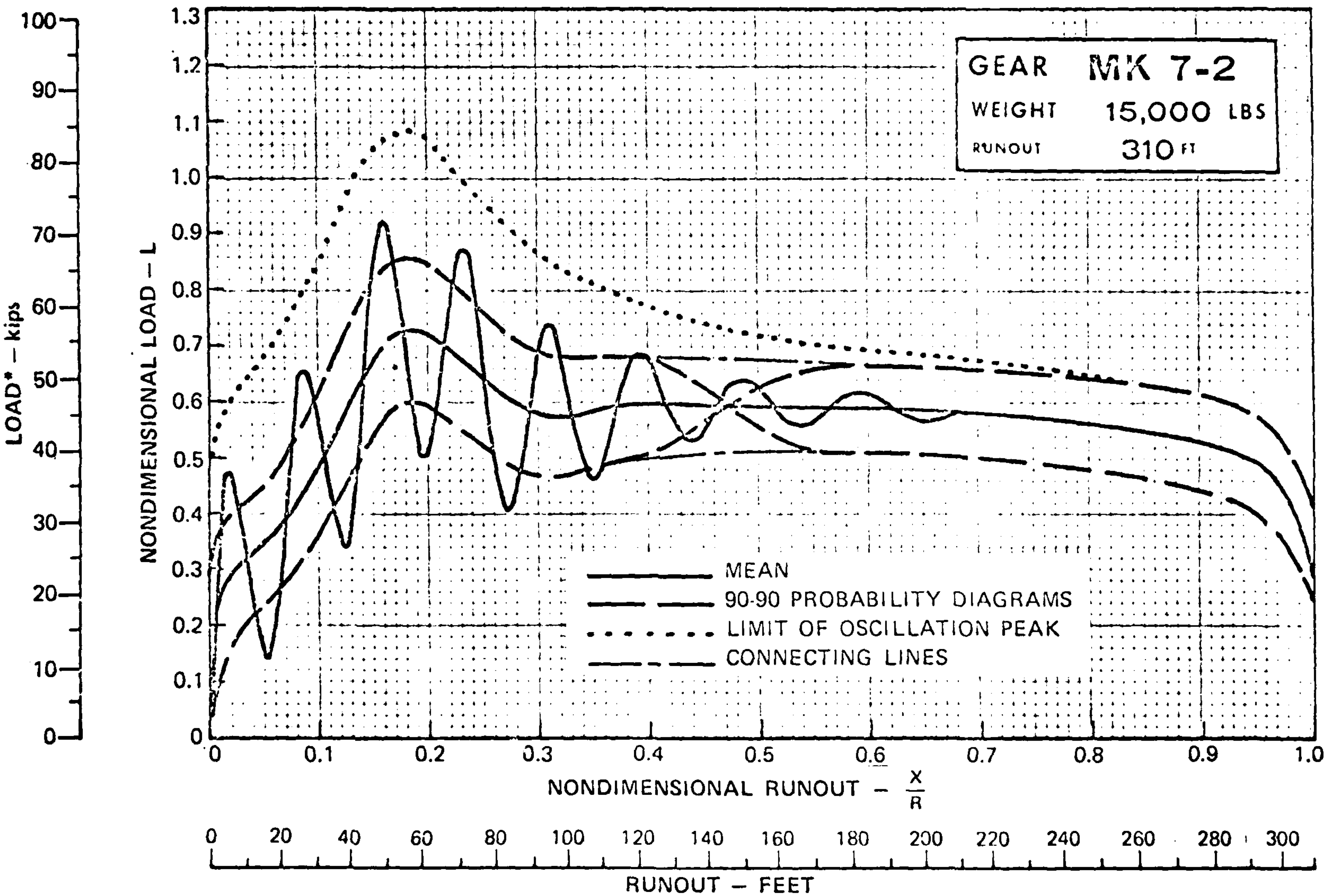
LOAD versus STROKE



*Dimensioned load scale for 135 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/135^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.23

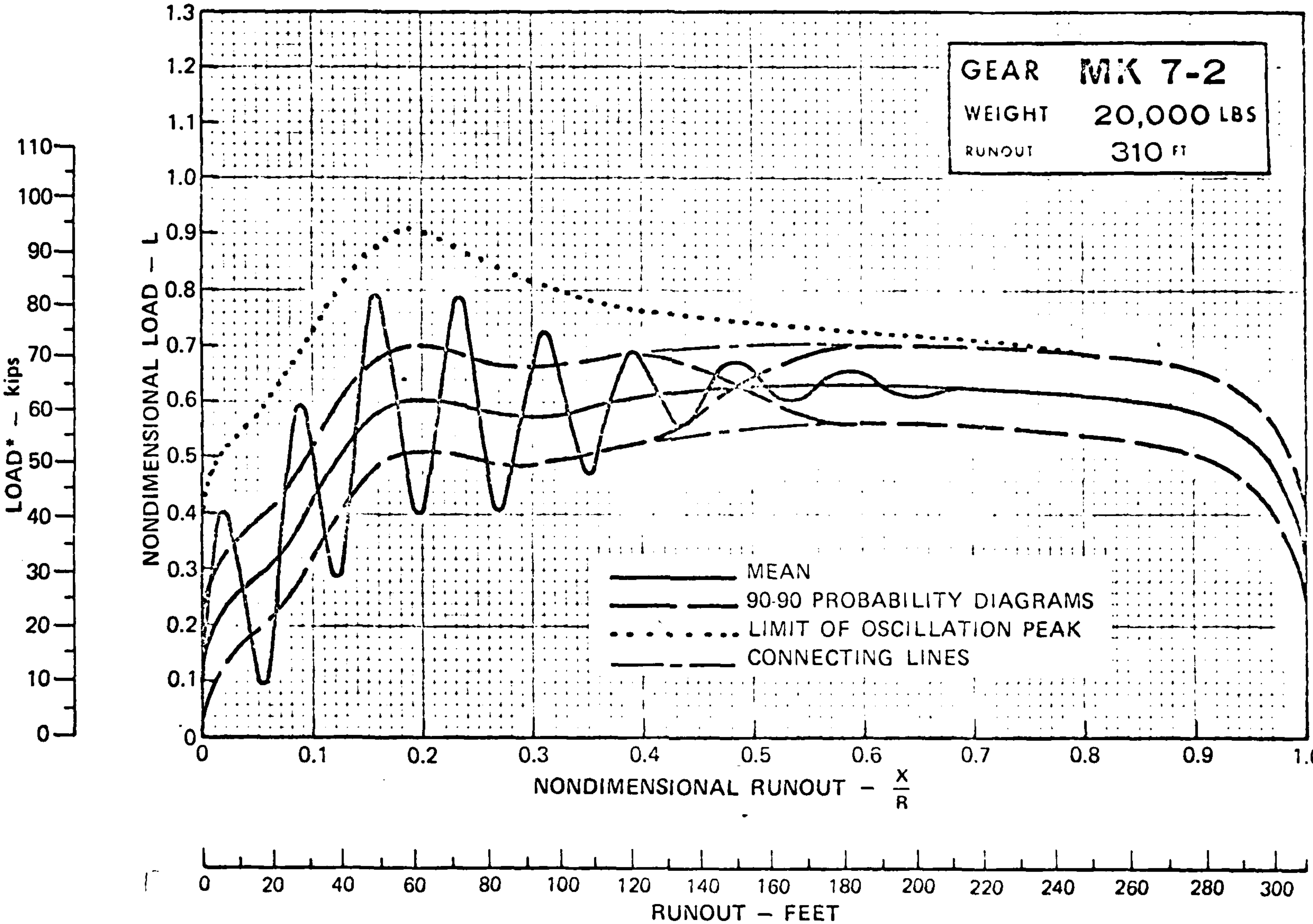
LOAD versus STROKE



*Dimensioned load scale for 135 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/135^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.24

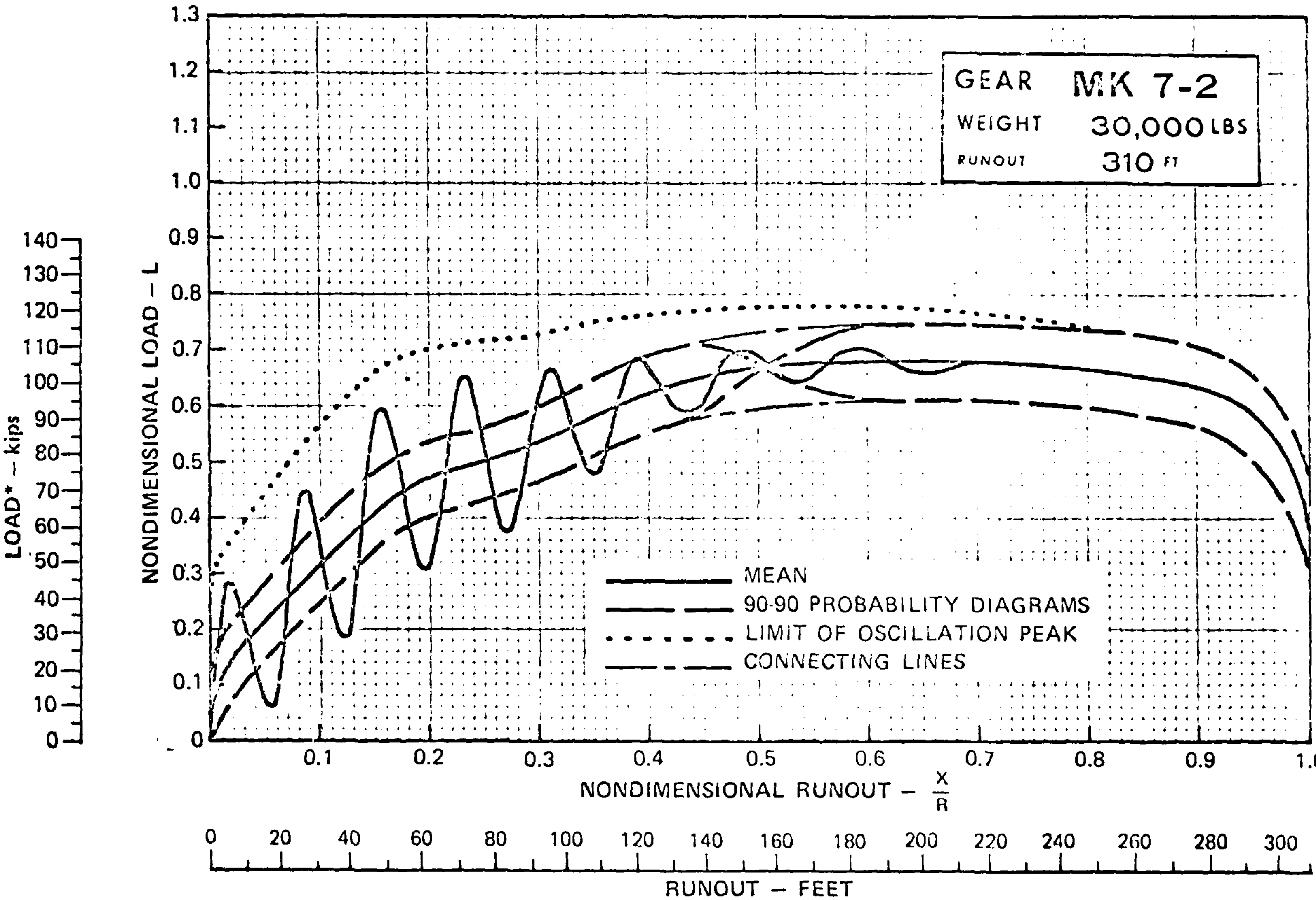
LOAD versus STROKE



*Dimensioned load scale for 135 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/135^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.25

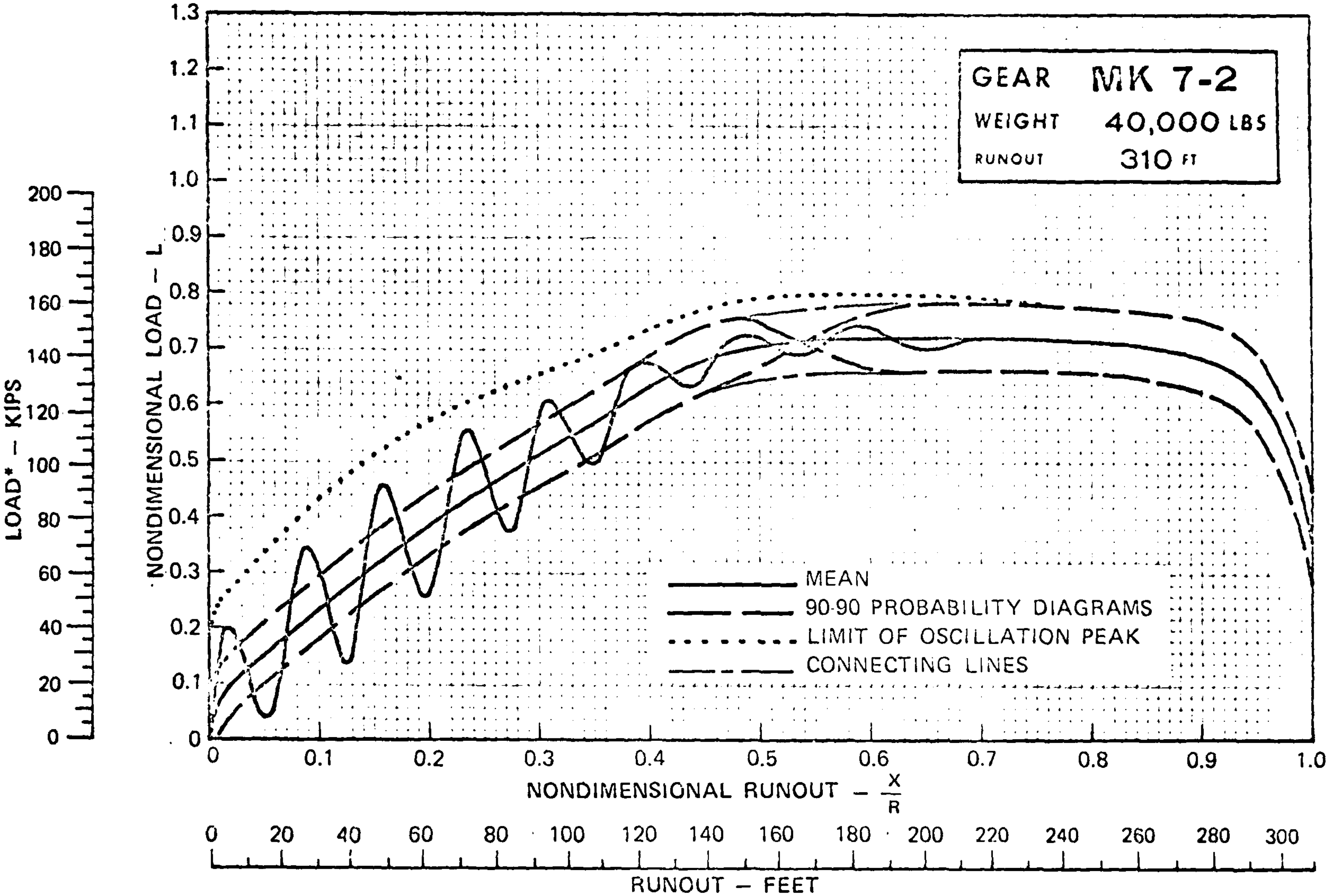
LOAD versus STROKE



*Dimensioned load scale for 135 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/135^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.26

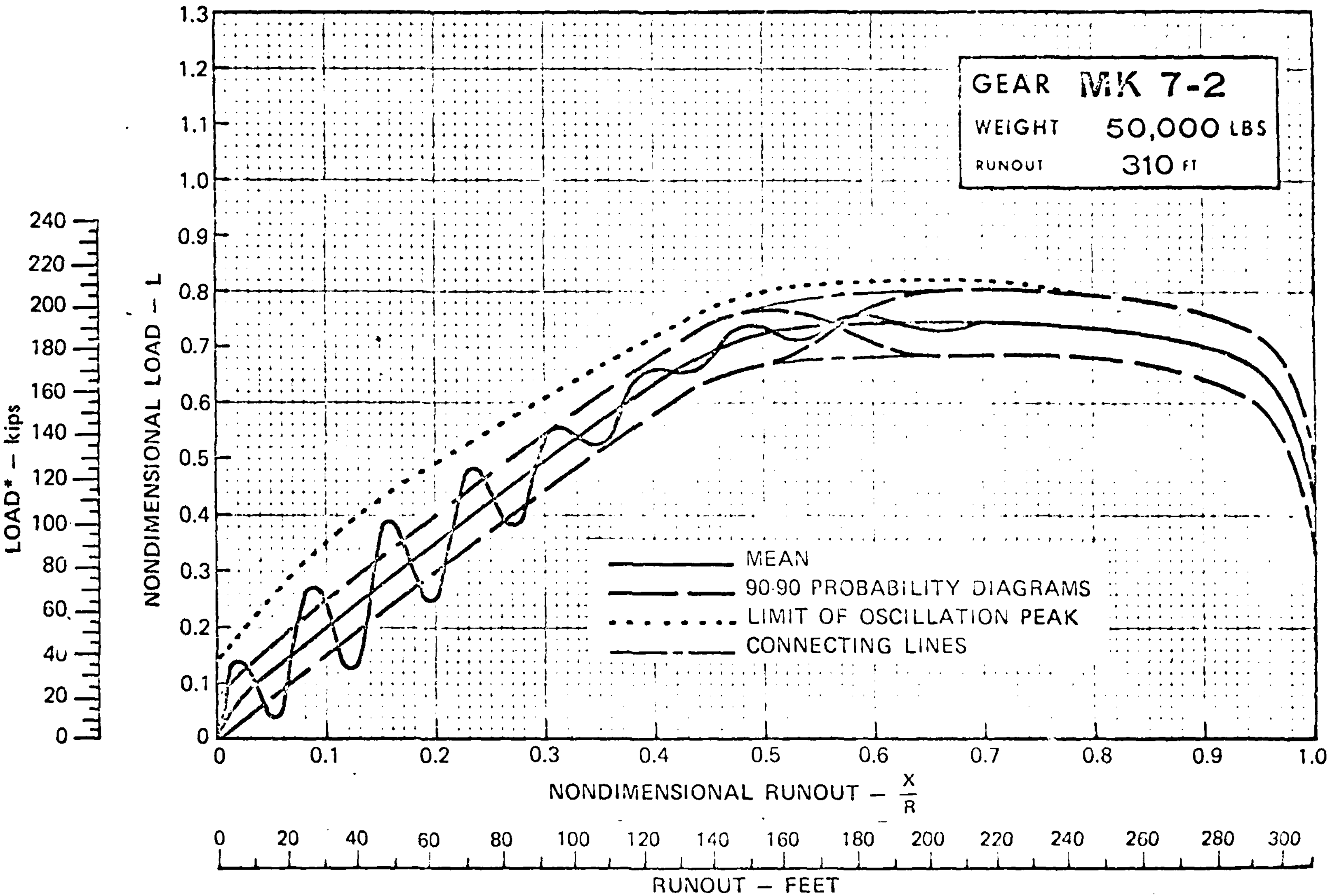
LOAD versus STROKE



*Dimensioned load scale for 135 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/135^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.27

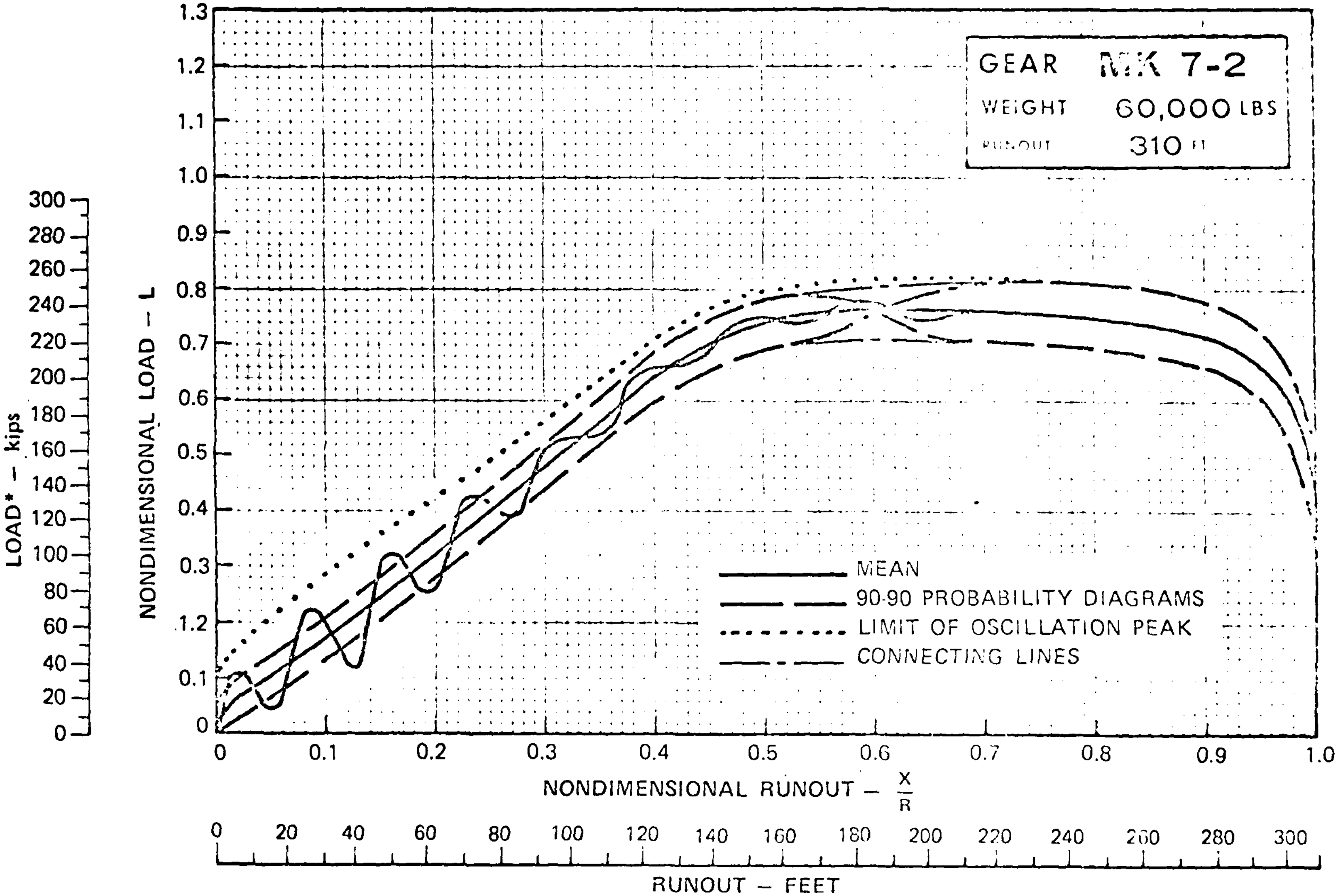
LOAD versus STROKE



*Dimensioned load scale for 135 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/135^2$ x correction factor x dimensioned scale; where V_E is in knots.

Figure F1.28

LOAD versus STROKE

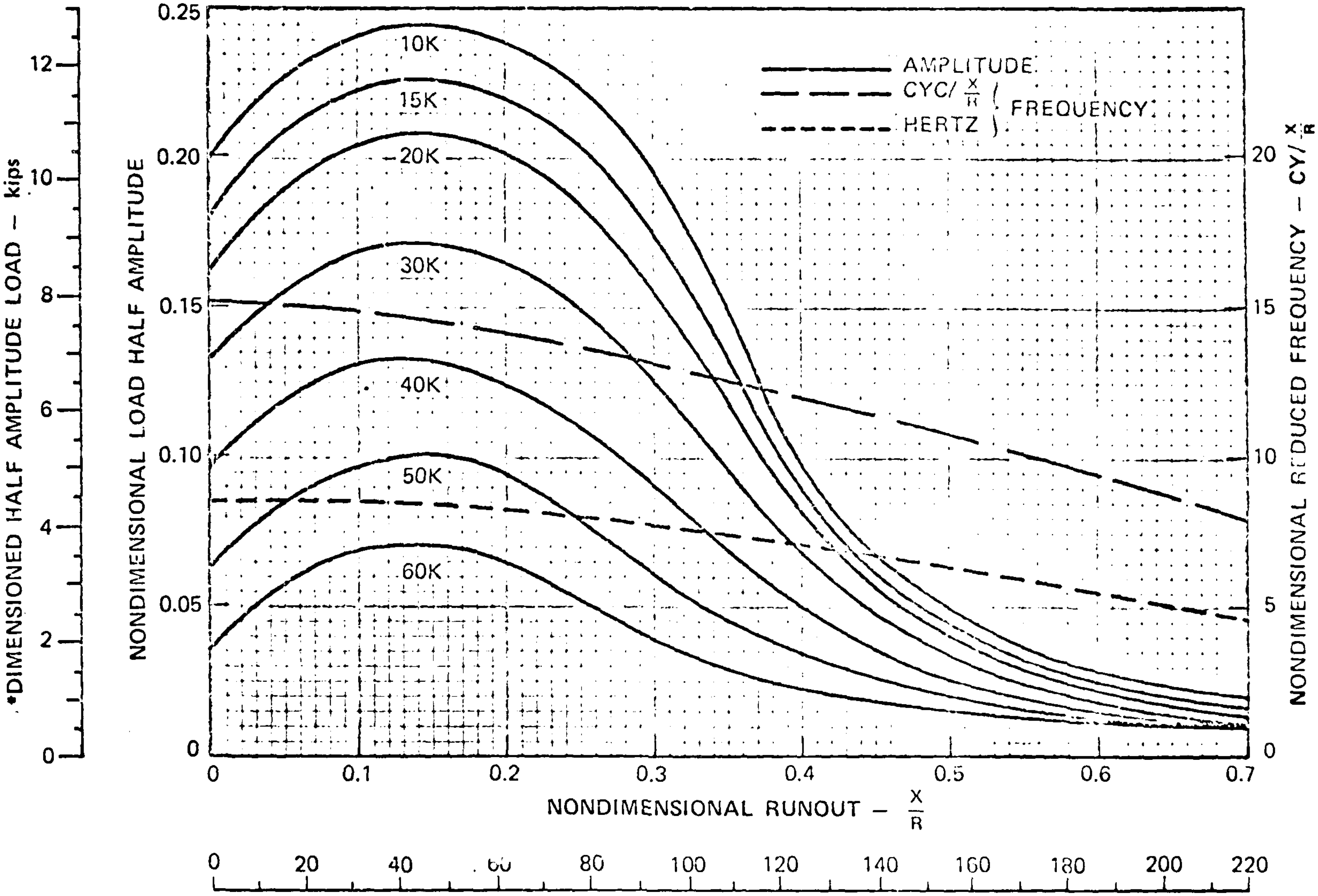


*Dimensioned load scale for 135 knots engaging speed and thrust of 0.4W only. Other engaging speeds and thrust values require correction per ratio $V_E^2/135^2$ x correction factor x dimensioned scale, where V_E is in knots.

Figure F1.29

MK7—2 ARRESTING GEAR

AVERAGE FREQUENCY AND AMPLITUDE OF ARRESTING FORCE OSCILLATION



*Dimensioned half amplitude load scale for 10,000 lb airplane weight, 135 knot engaging speed, and 0.4W thrust only. Other weights and engaging speeds require correction per ratio $\frac{V_E^2 \times \text{weight}}{135^2 \times 10}$ x dimensioned scale x correction factor. V_E is in knots and airplane weight W is in kips.

Figure F1.30

MK7-2 CORRECTION FACTOR

CORRECTION FACTORS TO ADJUST THE ARRESTING LOAD FOR VARIATIONS IN THRUST AND ENGAGING SPEED

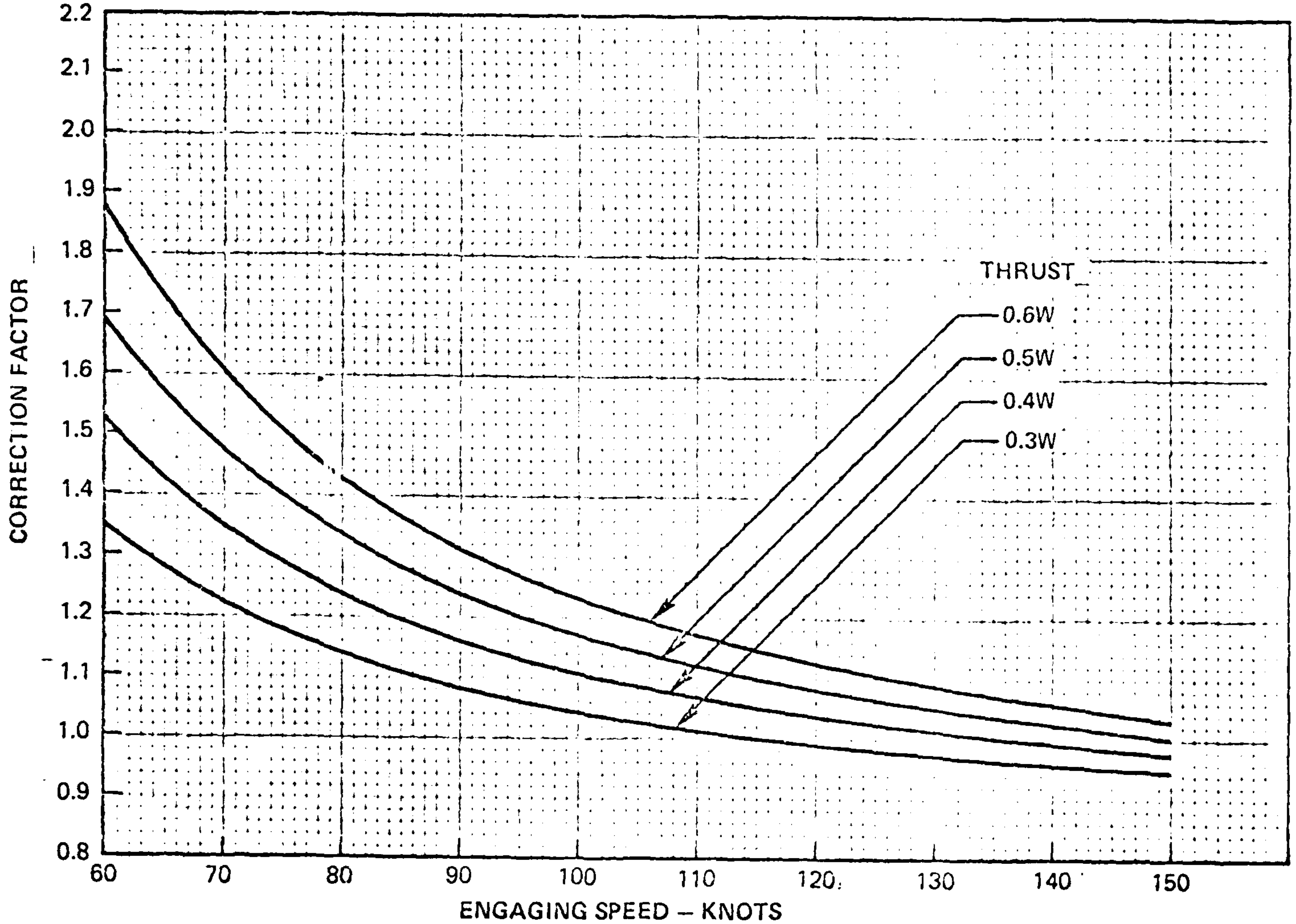


Figure F1.31

MK7-2 ARRESTING GEAR

LIMIT ENGAGING SPEED

as a function of

AIRPLANE RECOVERY WEIGHT

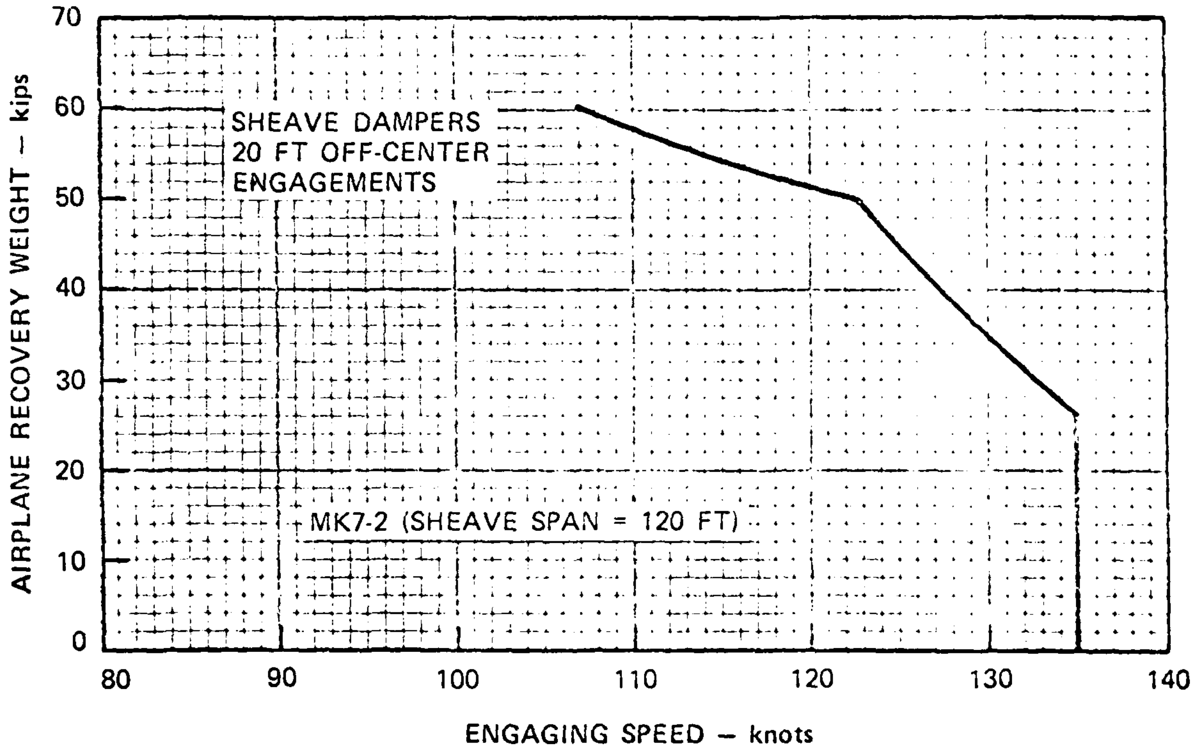


Figure F1.32

MK7-2 ARRESTING GEAR

MAXIMUM PEAK ARRESTING FORCE

AS A FUNCTION OF RECOVERY WEIGHT AND ENGAGING SPEED

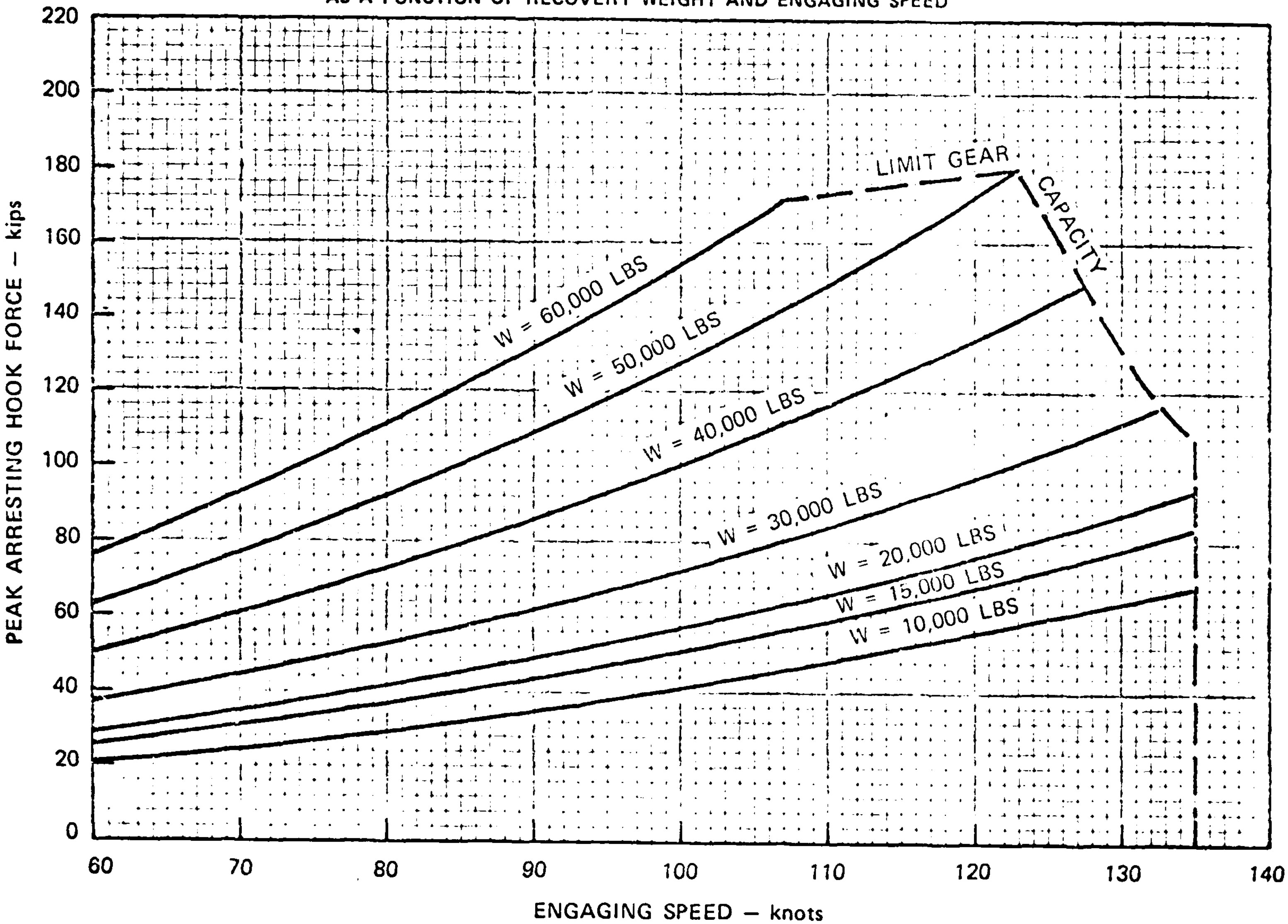


Figure F1.33

MK7-2 ARRESTING GEAR

MEAN PEAK ARRESTING FORCE

AS A FUNCTION OF RECOVERY WEIGHT AND ENGAGING SPEED

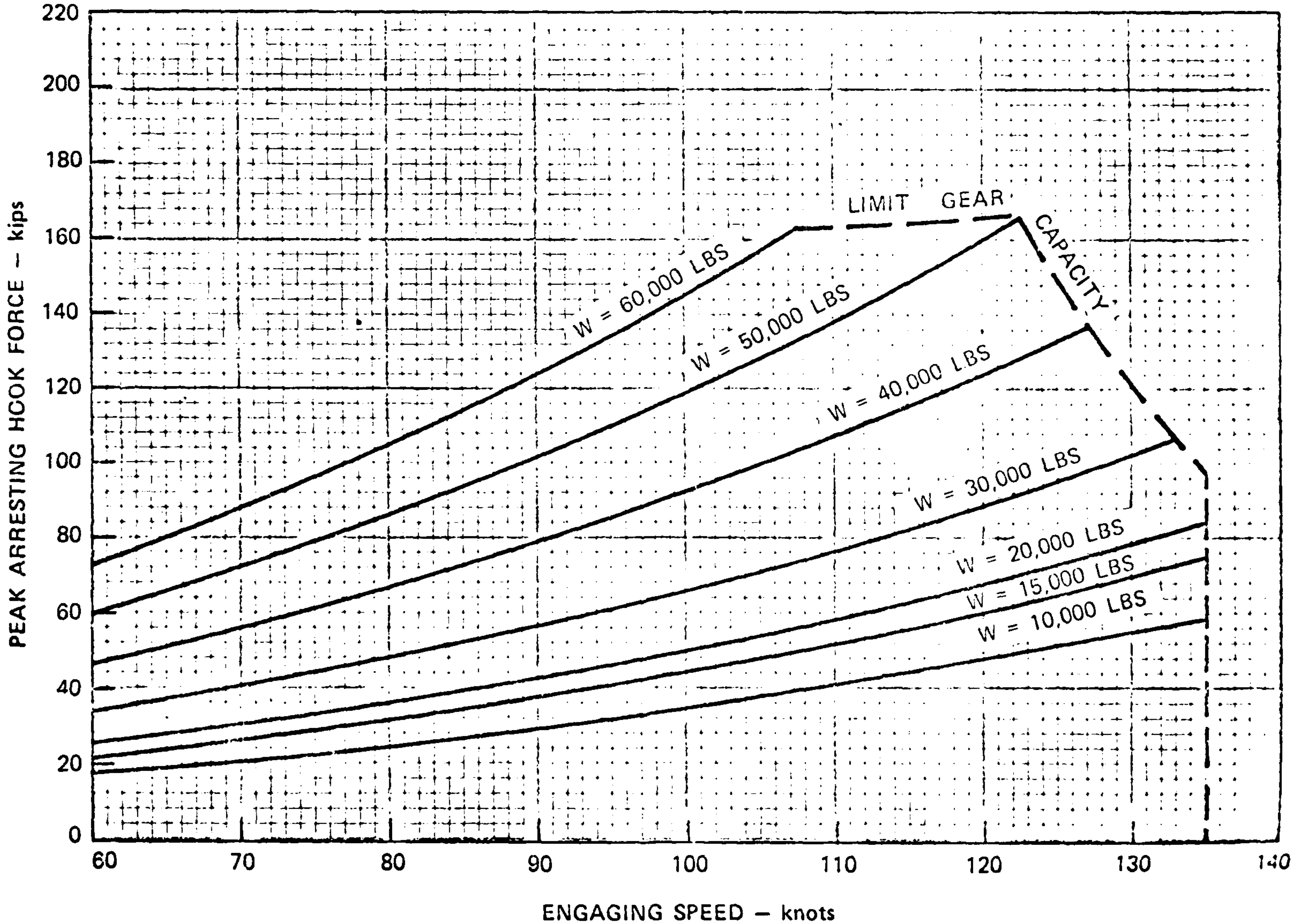


Figure F1.34

MK7-2 ARRESTING GEAR

RELATIONSHIP OF NONDIMENSIONAL STROKE, TIME, AND ENGAGING SPEED

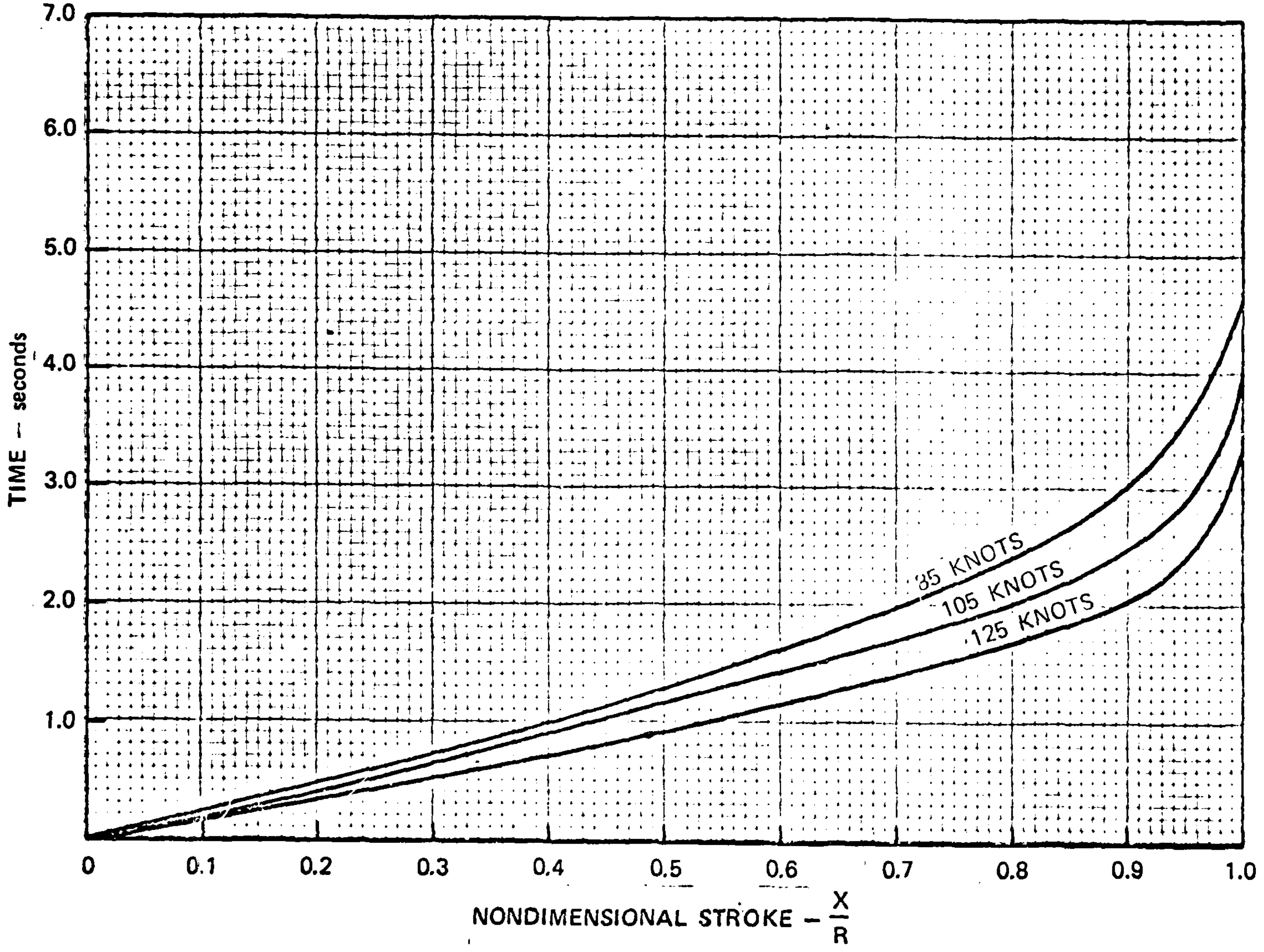


Figure F1.35

MK7-2 ARRESTING GEAR

NONDIMENSIONAL DIAGRAM SHAPE COMPARISON

RECOVERY WEIGHT = 50,000 LBS

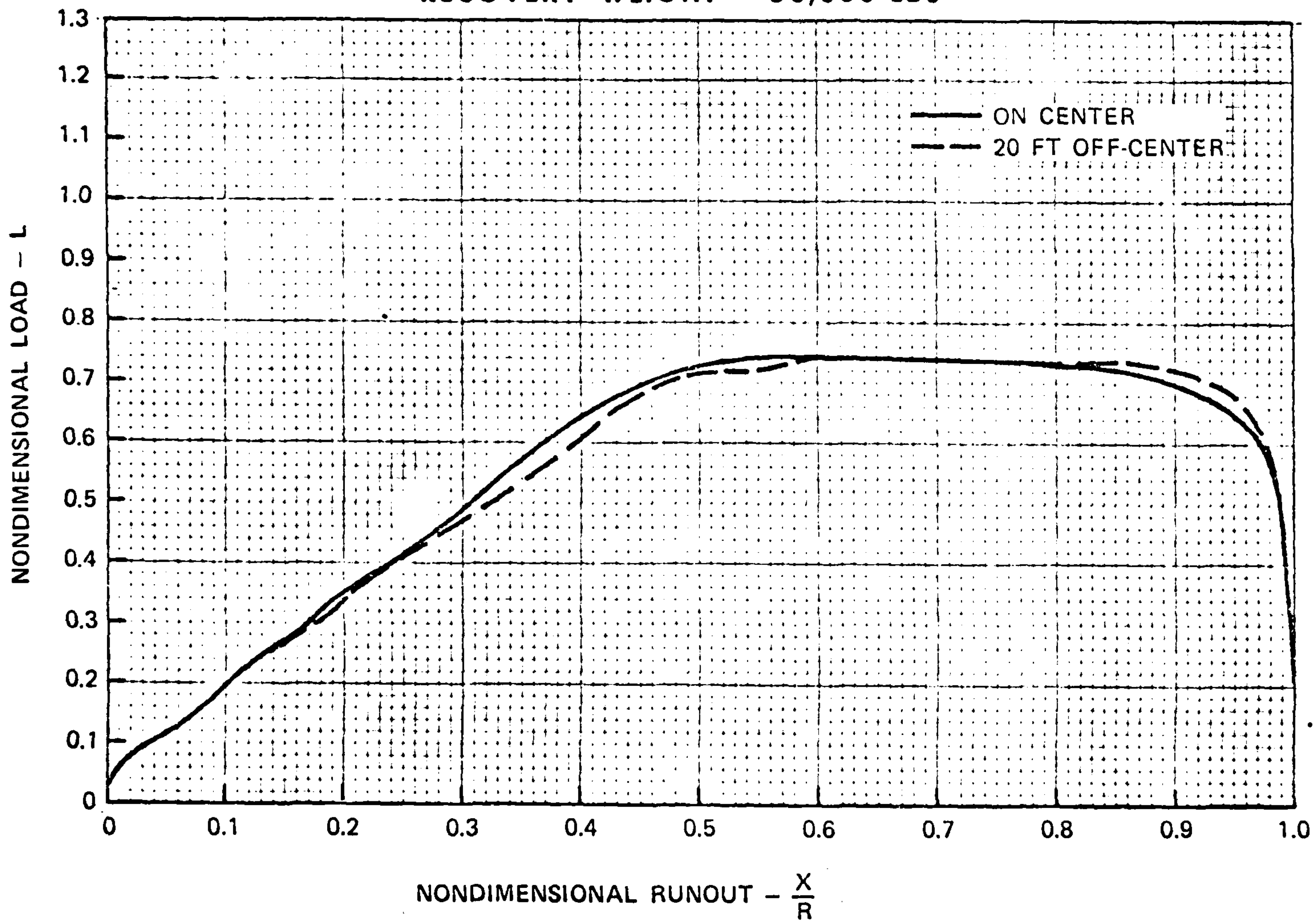


Figure F1.36